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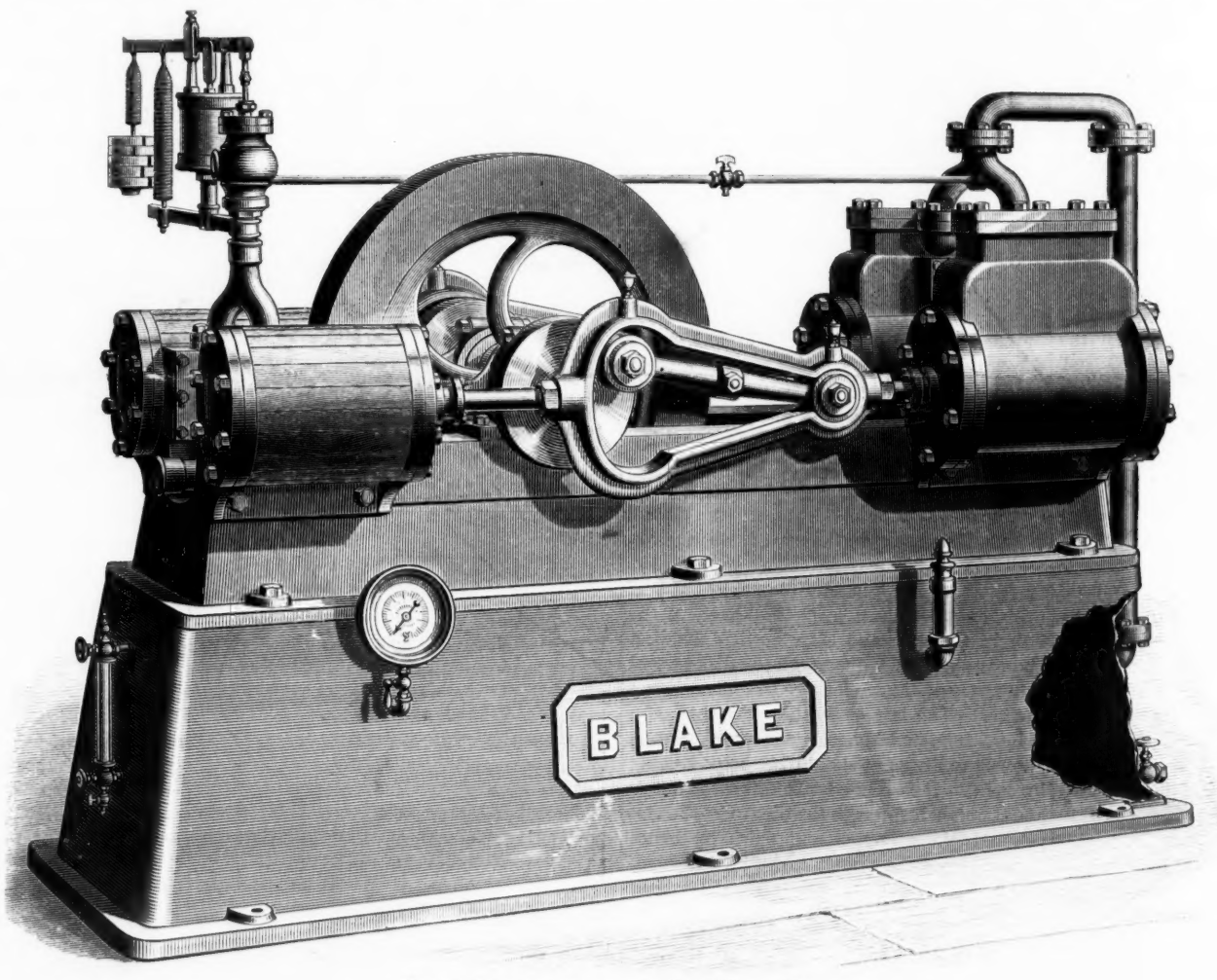
Blake Duplex Crank and Fly-Wheel Pump.

We herewith give an engraving of the Blake improved duplex crank and fly-wheel air pump. This pump is constructed for racking off beer in breweries, and for other purposes where maintaining an exact pressure of air is necessary. As beer cannot be pumped without injury from the churning action, the usual method of transferring it from the vats into barrels is by subjecting the vat to a pressure sufficient to raise the liquid to the required height by means of pipes leading from the lower part of the vessel. As a slight increase of the calculated pressure would be likely to burst the vat, it is important to have a pump that will be self-regulating. This new Blake pump seems to meet the requirements in a satisfactory manner, and considerable ingenuity has been used in perfecting the self-regulating arrangements. The pump has two steam cylinders connected to the cranks at right angles so as to avoid dead points. The speed is regulated automatically by the pressure within the air receiver. A small vertical cylinder is set beside the steam pipe, and the movement of its piston opens or closes the steam throttle. A small pipe reaches from the main air pipe to the bottom of the vertical cylinder. By an arrangement of weights and springs the upward travel of the piston can be regulated so that the required pressure of air will hold it in the proper position for giving the steam-throttle the necessary opening. The slightest increase of air will raise the piston and tend to close the throttle; ½ lb. more than the normal pressure will close the throttle aud stop the engine. By this means the engine starts and stops just as the demands for air require it to work. The main air reservoir belonging to the pump is below the bed casting. To perform the air compression economically a small quantity of water is fed with the air and lodges in the bottom of the reservoir, which is fitted with a glass tube to indicate the height of the water. This reservoir is also supplied with a pop safety-valve to make the security against over-pressure doubly sure. All the working parts of the pump are easily got at for examination or repairs. The valves of the air cylinders are readily reached through the covers, which are conveniently placed on the tops of the cylinders. These valves are very durable and not liable to derangement. This pump is made by the Geo. F. Blake Manufactnring Co., New York and Boston.



BLAKE DUPLEX CRANK AND FLY-WHEEL PUMP.

Extracts from Chordal's Letters.

FINE AND COARSE FEED ON LATHE FACE PLATES—GRINDING SURFACES WITH EMERY—SCRAPING SURFACES—A NEW MACHINE SUGGESTED—A QUERY.

Mr. Editor:

* * * A short time ago I was in a machinery wareroom intending to examine closely a couple of lathes, from different makers, having a swing of about two feet. My attention was particularly attracted to the remarkable difference in appearance of the two face-plates, or the finish of the face-plates rather. One of them had been faced off with a broad-nosed tool with a feed of about half an inch; the other had been faced off with an exceedingly fine-pointed tool, with a feed of about one-hundredth of an inch. One of them was not remarkably coarse for a coarse feed, and the other one was astonishingly fine even for a fine feed. So far as good looks were concerned both of these surfaces were infernally ugly. The broad cut work showed that peculiar dark, teary, felty stripe alternating with a narrow stripe of lighter color. The light-colored stripe would stay light colored, and would clean off nicely; the broad stripe, being somewhat rough and furred, would hold the color of grease. Finger marks cannot be cleaned off this kind of work. Good looks must depend upon uniform dirtiness. The fine feed surface presented generally a brighter aspect, but fouled much worse. The surface was almost wiry. The only way to get this clean is to dirty it uniformly all over and then wipe it into respectability. Taking the time probably consumed in facing off these two face-plates, I would put it as being in direct proportion to the feed—say about 40 to 1. While it is well understood that broad tool work involves, or should involve, a slow cutting speed, it is also well understood that no tool with an extremely fine point will stand any high cutting speed. One hour's facing work on one of these face-plates could safely be said to represent forty hours' work on the other face-plate. So much for the cost. As for the truth of surface, I do not suppose the superiority of the broad cut work is open to doubt. So far as good looks are concerned it does not enter into the question of face-plates, because truth is the thing required, at the expense of everything else, if need be.

* * * But there are cases where good looks constitute the main point for consideration. Take a lathe rest for instance, not the wings of the carriage where work is to be bolted, but the outside of the compound rest work. This work does not have to be true; it does not have to be planed; it does not have to be polished. It is an untouched casting on the lathes of some builders—those by Pond, for instance—and it is an elegant piece of finished work on lathes of other builders, as those by Grant & Bogert, for instance; and it is simply broad-cut planer work on those of other makers, as William Sellers & Co., for instance. Grant & Bogert finish these things and they do it for looks; it is their idea of beauty. Pond leaves them rough and paints them, because he is not after beauty; it is his idea of the proper thing. William Sellers & Co. plane them, and it must be for beauty; there can be no other motive. If I am not mistaken, William Sellers & Co. build lathes, of some particular size at least, on which there is no hand-finishing done—that is, the surfaces are planed up for looks, but are left as they come from the planer. As examples of fine planer work I do not suppose their superior can be found in the world. I never can help admiring this kind of work, as work, though I never could get into sympathy with it as a surface made for looks only. It is not beauty, it is art.

At the late National Exposition of Railway Appliances, I noticed one of these Sellers lathes with its seersucker finish—magnificent planing. I noticed one thing, however, and that was that on most every piece of this particular lathe these broad sweeping cuts would be carried across a piece to near the finish, and then for some unaccountable reason something would happen; the feed would be a trifle greater or a trifle less, or there would be no feed at all; anyhow something to mar the beauty of these surfaces as examples of most excellent planing.

* * * These broad-tooled surfaces are not always what they seem. Some concerns have adopted this style of tooling without instructing their planer hands fully in the theories involved, and as a consequence, the men have fallen into habits of using tools of great breadth, but of too great fullness. They put on the coarse feed (½" or so) and produce the appearance of the thing sought for. An attempt to finish these surfaces by filing may show them to be composed of parallel gutters of rather serious depth. The work of Sellers, above referred to, will be always free from this defect: at least, that is my opinion, and very little afterwork reduces these surfaces to a finished condition.

* * * A file will take hold of a plain surface produced with a fine feed better than it will a broad-tooled surface, but it will have to keep hold a great deal longer. In fitting solid unmoving contacts, as bolted joints, for instance, by means of the scraper, the fine feed surface can be got into contact the quickest and with least work. Only the tops of the ridges may need to be scraped down to correct a trifling error in flatness, while solid iron would have to be worked to correct an equal equal error in a broad-tooled surface, but in the first case the work must be finally covered up so that it cannot be seen.

* * * There are still in existence machine-

tool building shops which fit a moving surface to its bed-piece by means of oil and emery. This process imbeds a fine emery powder into the surfaces. In grinding a cylinder-head to its place this powder may stay in the iron and do no harm. A safety-valve thus ground will have its surface cleaned by the blowing steam. For the taper plug of cocks it is bad in the absence of some thorough cleaning process. This imbedded emery is always present in ground surfaces, and is evidenced by a peculiar lead-colored tint. The character of the surface is due to the grinding. This peculiar color is due to the imbedded emery. The process will secure good contacts, and, to a certain extent, it tends towards the truing of surfaces, bnt the process does not yield smooth surfaces; it does not yield true planes, and it does yield surfaces charged with grit. These surfaces always behave badly. If a lathe-carriage does not fit upon its V's, grinding with emery will undoubtedly make it fit; but taking everything into consideration, I do not think the ordinarily ill-fitted surface is improved by this emery grinding, either in its trueness of motion or in its durability of truth.

* * * The mechanical mode of treating such surfaces is to make one of the surfaces true and smooth, and free from longitudinal scratches, by any efficient means, and then to fit the other surface to it by any efficient means. The means generally adopted for this fitting is the scraper, and there are tricks in the use of the scraper understood by but few machinists. A file can, of course, be used. It is a quicker-acting tool than the scraper, but does not produce work quite as smooth, and it cannot be used in the odd corners of sliding fits as a scraper can. Either the file or the scraper is a hand tool, and involves expensive hand manipulation at a rate of progress which cannot be increased.

* * * The objection existing, and properly so, against grinding two surfaces together with emery, does not hold good with the dry grinding of a single surface. A surface cut by a dry emery wheel is free from imbedded emery. If an emery wheel could be so manipulated as to touch in spots as accurately as a scraper, a new method might be devised for fitting flat surfaces.

For many years I have been under the impression that some fine day we would have a delicate flexible shaft armed with an emery button—say, an inch in diameter—to be used as a grinding disc, cutting with its face. This delicate apparatus could be used on work in place of the scraper, and would produce a surface of desired smoothness, of pleasing appearance, and of an accuracy depending upon the skill with which it was used, the same as a scraper. The appearance would be much like that of the charcoal finish seen in many watch movements, safe locks, and such things. The surface would be pleasing and it would look hard. This appearance of hardness in a surface is the something greatly to be desired. It is not secured by emery grinding; it is not secured by filing, and it is not secured by tool-cutting with either fine or coarse feed. It is produced by scraping, by dry grinding, and by flat hammer blows.

* * * For the emery button in this process substitute a finely cut end mill to be run at high speed by the flexible shaft. Call it a rotary file or a rotary scraper, will it quicken the process of accurate surface fitting?

* * * Very respectfully,

Chordal.

It is reported that Master Mechanic Conlin, of the International Railroad Shops at St. Louis has resigned his position, because the railroad managers would not allow him to employ sufficient men to carry on the work. This is one of the great Gould combination of Southwestern railroads.

During the last week the Rogers Locomotive works of Paterson, N. J., turned out ten locomotives. They were mostly eight-wheel engines, for the Missouri, Kansas and Texas, and other Southern roads. They are engaged working on twenty-six engines for the Panama Canal Company. Of these, three are eight-wheeled American pattern, and the others ten-wheel engines. All this group of locomotives have names mostly after French departments.

Making and Repairing Dies, and Cutting Bolts.

By M. D. Luehrs.

It is astonishing how few machinists can make a perfect bolt cutter die. It is safe to say that not one-fourth of all bolt cutters in operation to-day cut a clean thread, most of them producing ridges on iron, that are not cut but are squeezed or worried on at no definite angle or pitch. Pick up an average $\frac{5}{8}$″ bolt and measure the number of threads per inch and it will puzzle you to know whether it is 11 or 12 threads. This can all be avoided; threads can be *cut* with nearly all machines. It don't pay to squeeze the threads, as it not only spoils the bolts but also the dies, and in fact the whole machine. It takes an immense amount of power to squeeze up a thread, which generates heat and soon renders the dies useless; besides this drag of the dies on the work exerts an immense pressure on the head, which in time ruins it.

There are several vital points to consider before cutting dies in any bolt cutter. First see what kind of head the machine has; whether the die is placed so the cutting edge is on line with the center, as in Fig. 1,

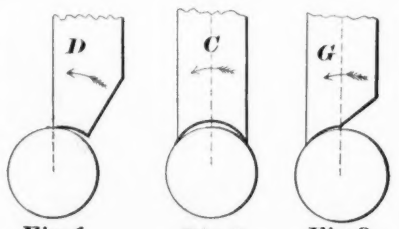


Fig.1 Fig.2 Fig.3

or ahead of the center, as in Figs. 2, 3 and 4. Suppose you want to cut a set of dies in the 2-die machine. First see that the spindle and carriage or the vice jaws are in line, for if they are not, there is no use cutting dies on that machine. If the bolt enters the dies at an angle you not only spoil the bolt but the dies as well. After you are sure that all is true, then examine the master tap, or hob, which in a 2-die machine should be from $\frac{1}{100}$″ to $\frac{1}{50}$″ smaller in diameter than the bolt you wish to cut. Then grip the shank of the hob in the vice and start cutting the dies. Run the master tap through the dies several times, each time closing the dies down further. The last or finishing cut should be a light one, and the carriage should not be allowed to drag but should be helped along by hand. It is a good plan after the hob is about one-half through the dies to let the vise off, and take a wrench and finish by hand. A very important point must be observed, that is, to see that when revolving the head the hob runs true, for if the dies have not been tapped out perfectly true they cannot be expected to do good work; besides the strain while cutting will often break the dies. These little points are seldom thought of. After the dies are threaded take a short taper reamer and ream the throat or entrance

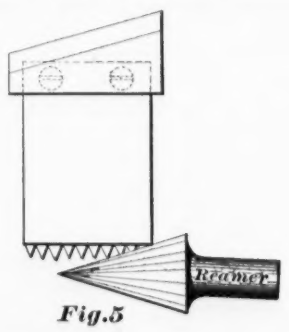


Fig.5

as in Fig. 5, reaming in not over three threads. This will be a guide to file them to; in filing take away the center and back, but nothing off the cutting edge. Dies reamed in this manner will cut equal.

Right here let me say that the cause of bolts heating while being cut is friction, not cutting, for cutting produces very little heat; so when you have hot bolts leaving the dies it is high time to attend to removing the cause.

With the four separate die machines, if the dies are placed in the head, as in Figs. 2, 3 and 4, ahead of the center, cut them with a hob smaller than the bolt; if placed as in Fig. 1, the hob should be larger than the bolt, in order to get the clearance. This latter style is too much like a lathe without an adjustable or elevating tool-post, where the tools are placed the same for turning $\frac{1}{4}$″ or 12″ in diameter. If the dies are placed as in Figs. 2, 3 and 4, ahead of the center, you can cut either right or left hand threads on the same machine.

It often happens that a party has one machine with dies placed as in Fig. 1, and buys a new machine with dies as in Figs. 2, 3 and 4. After the new dies get dull they take their old hobs and go at them. The result is the new machine soon gives out, and the maker gets the blame; whereas if the man that had cut the dies over had used the proper hob, the machine would have run for years.

There is also another very common evil; that is, allowing the dies to get too dull before sharpening or grinding. Go into most shops and watch the boy when he starts a bolt into the dies and see him push with all his might on a lever or hand wheel. This is all wrong. A pressure of one pound should start the bolt. When the bolt enters hard, take the dies out and you will find the throat all bright. Grind this bright center off, leaving the cutting edge in good shape, and you will see the change at once.

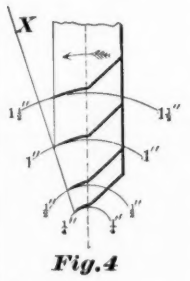


Fig.4

One more point in regard to making new dies and grinding them when placed as in Figs. 2, 3 and 4. Be sure and keep the cutting edge higher than the heel, as in Fig. 6. It is a very common thing to see them made and ground as in Fig. 7, so that when a try-square is placed on face of die the heel will strike the blade first. This is a very common occurrence; result, poor threads and friction, besides broken dies. Another fault often met with in cutting dies is a sprung or crooked hob; also one that after tempering has lost its lead or contracted unequally. This is often found in the "home-made" taps where "cheapness is boss." One rarely finds this in a hob made by our regular manufacturers of taps. In dies tapped with a sprung or unequally contracted hob, the bottom of the threads in the dies are very flat and the tops sharp, or in other words there has been too much removed from the sides of the threads. The dies resemble those made for cutting wood or lag screws.

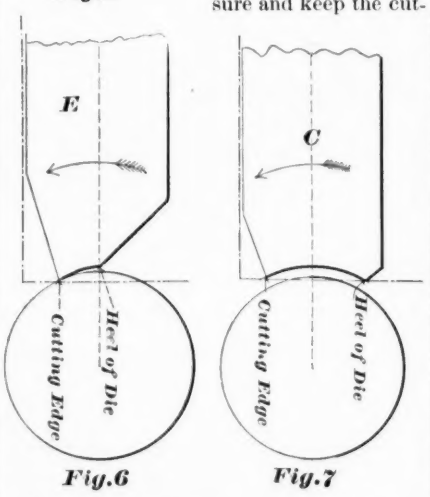
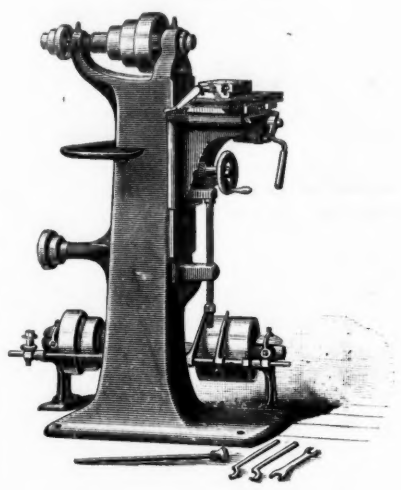


Fig.6 Fig.7

The most difficulty is experienced in getting the fine pitches, or $\frac{1}{4}$″ and $\frac{3}{8}$″ dies to work well, for the slightest defects are quite perceptible. One way of lessening some of these is to use a hob made slightly tapering, smaller in diameter next to the shank. About $\frac{1}{100}$″ to 1″ in length will do. This is about the same in principle as employed in setting a square nose tool on a shaft when taking the finishing cut in a lathe.

Almost all dies have different widths. The $\frac{3}{8}$ dies are $\frac{1}{2}$″ wide and the 1″ dies $1\frac{1}{4}$″ wide, &c. By using the taper hob the $\frac{3}{8}$″ dies can be left as wide as the steel without injury to the threads they cut, for if the dies do spring a trifle they will not come in contact with the bolt they cut for any length. Wide dies can be ground more times before they need recutting, so it is better to use this taper hob, which can be used to good advantage on all open die machines, and particularly on the smaller sizes of dies, say from $\frac{5}{8}$″ down.



Small Automatic Milling Machine.

The machine illustrated above is one of the recent productions of E. E. Garvin & Co., 139 to 143 Center street, New York City, and is designed to meet the wants of those requiring rapid and convenient handling of small work.

The base or column is of a rectangular form, containing a cupboard, making a convenient receptacle for tools. On the front is cast a projection for the elevatiug screw. In the rear is one for the feed shaft and cone, containing babbitted bearings for the shaft. It has the advantage of using an extra long feed belt. A square hollow pan is fitted near the top for keeping tools within reach.

The spindle has a front bearing $1\frac{5}{16}$″ diameter and $3\frac{1}{4}$″ long. Both bearings run in composition metal boxes which are fitted in the heads with a taper and provided with span nuts so as to be always kept rigid.

The spindle cone has four changes of speed for a 2″ belt, and is connected with the spindle by a key. The spindle can be adjusted by means of a nut bearing on the cone.

Work can be lowered 12″ from the center by means of the knee being connected to a screw operated by a hand wheel and bevel gears. The movement is regulated by check nuts used as stops.

The transverse motion is obtained from a screw operated by a crank wrench. The table has a 7 in. automatic feed derived from an intermediate feed shaft connected by a clutch with worms and screws located inside the column, keeping them free from dust and chips. Provision is made for self-oiling. Adjustable stops are placed on the table. A roller, fastened on the lever sliding over a pin, disengages the clutch and stops the feed. The feed is from a rack and pinion which is quickly reversed by means of a lever fastened to the pinion shaft. A hand-feed may also be obtained with this lever. The table, $4\frac{5}{8}$″ wide and 16″ long, is cast with a groove on all sides to receive oil and chips that are removed from the work. The countershafts provided with this machine have adjustable and self-oiling hangers.

The world is threatened with a second edition of the Keely motor. This time the genius hankering after fame by making something out of nothing hails from Brooklyn, N. Y. His "dynamic reservoir" at present is a prosaic coffee-pot, but this beverage decocter is alleged to contain a principle which will work a revolution in the present system of operating machinery. The only objection we have to this class of inventions is the barren sameness of the claims made for them. They are all going to revolutionize the application

of power, but they are never just advanced enough so that the inventor can publish details of the invention. This coffee-pot and its progeny are going to apply power by putting water in motion, but steam-engine makers are not getting alarmed about their coming rival.

New English Patent Law.

The new English patent laws which will come into operation on the 1st of January, 1884, effect important changes in the existing patent laws in Great Britain and Ireland. The Government fees to be paid on application for a patent are reduced to £1, and £3 more will secure the patent for a period of four years. At the end of four years, should the inventor desire to have his patent extended for the period of fourteen years, he is required to pay £150, but the money will be accepted in annual instalments extending to the thirteenth year. Patents will be granted to the inventor jointly with others, but the inventor must make a declaration that he is the true and first inventor. Applicants may transact all their business direct with the patent office, and the necessary blanks must be kept at the various post-offices. Applicants for patents are required to make a provisional specification describing the invention which will be referred to an examiner, whose duties will be to decide whether or not the applicant is entitled to a patent. This being decided in the affirmative, the applicant must then prepare a final specification, which becomes the basis of the patent. Should the applicant be dissatisfied with a decision of the examiner refusing to approve an application for a patent, he can appeal to the law officers. The final specifications must be in within twelve months of the date of application or the patent will be void.

A Standard British Wire Gauge.

The question of a standard wire gauge for Great Britain has at length been settled in favor of the following scale which will take compulsory effect March 1, 1884:

Descriptive Number B. W. G.	Equivalents in parts of an inch.	Descriptive Number B. W. G.	Equivalents in parts of an inch.
NO.	INCH.	NO.	INCH.
7/0	0.500	23	0.024
6/0	.464	24	.022
5/0	.432	25	.020
4/0	.400	26	.018
3/0	.372	27	.0164
2/0	.348	28	.0148
0	.324	29	.0136
1	.300	30	.0124
2	.276	31	.0116
3	.252	32	.0108
4	.232	33	.0100
5	.212	34	.0092
6	.192	35	.0084
7	.176	36	.0076
8	.160	37	.0068
9	.144	38	.0060
10	.128	39	.0052
11	.116	40	.0048
12	.104	41	.0044
13	0.092	42	.0040
14	.080	43	.0036
15	.072	44	.0032
16	.064	45	.0028
17	.056	46	.0024
18	.048	47	.0020
19	.040	48	.0016
20	.036	49	.0012
21	.032	50	0.0010
22	.028		

The above table of sizes is awkward and arbitrary. Let a notched gauge be made ever so accurately to correspond to the above sizes and it will not remain accurate any considerable length of time in active use. The notches will wear larger, and the gauge will then determine nothing more than approximate sizes. The only accurate and convenient way to gauge wire and steel metal—a way open to universal adoption—is to measure those articles, and the most convenient and reliable instrument to use is the micrometer caliper. It can be so readily adjusted that the wear of parts coming into contact with the object to be measured does not affect its accuracy.

The Milling Machine—Its Construction and Uses.

FOURTH PAPER.

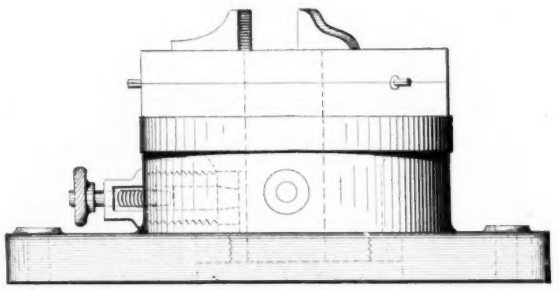
By John J. Grant.

In the Brown & Sharpe Universal Milling Machine the traversing table or platen has T slot running through its entire length. This, I think, is really an essential thing in all milling machines.

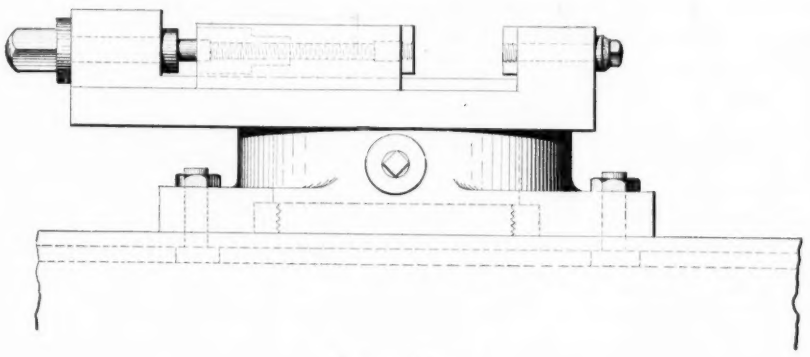
The advantage of this manner of fastening the vise and fixtures is that they are more readily changed; it also obviates the necessity of drilling holes through the platen, thereby doing away with the annoyance of chips and dirt falling through upon the screw or rack.

The vise or chuck being the most important fixture I will discuss this first. As they are generally made they are weak, not having metal enough in the base. I believe the common style could be improved upon by making it heavier, also by making it to adjust more quickly—that is, the front jaw. This should be made so that a simple movement of a lever would open it enough to take out the work, and the screw used only to open or set the vise for different kinds of work. Jaws should be made with great care and as true as possible.

Another very handy fixture is a vise made



Revolving Chuck.



Swivel Vise.

with a swivel base, as shown in engraving. With this vise, work can be checked or cross-cut without removing it from the vise, pieces can also be cut off at any angle.

Next in value to the vise comes the index centers or head and foot block. If these are rightly designed and well made they are very useful as they can be used for gear cutting and other kindred operations. Centers for use on milling machines should be made without a base to connect them together, as work of a diameter as much larger as twice the thickness of the base can be operated on, besides affording the advantage of having one less joint between the cutter and the platen.

The index wheel should be made so that the worm can be disconnected to allow of a quick adjustment for coarse divisions, and should be made large enough to allow of three rows of holes near the center, of only 4, 5 and 6 in number respectively, for squaring, fluting taps and milling hexagon nuts and bolt heads. The worm when connected can be used for all fine divisions, and also for continuous milling or finishing around places that cannot be turned. If the centers, or more properly speaking the head-block, is made to elevate or turn up at any angle, bevel wheels can be cut. The spindle of the head center should be fitted to take the chucks, face-plates and fixtures that are fitted to the small lathes in the shop. It will also be a great convenience to have the centers to correspond to the lathe centers, as small drill chucks and other tools used on the lathes can be used in them.

Still another valuable fixture is a rotary chuck made in the following manner and similar to the engraving:

A base plate fitted with a tongue at the bottom is bored out and faced true at the top. The bottom is then recessed out to receive a threaded annular ring. A top piece is fitted into this and threaded at the bottom to receive this ring which is screwed up against the shoulder leaving the top piece free enough to revolve. A spring bolt is fitted to the base plate and hardened steel bushings are fitted into the top piece. The divisions should be quartering and hexagonal. A chuck of the Horton pattern with three jaws made to bite on the inside only is bolted to the top piece. With this fixture, screw heads either square or hexagonal can be straddle milled. The fixture can be made very rigid, as it is so close to the platen. It, of course, can be used for a great variety of work that will suggest itself, and that would be impossible to enumerate in a short paper. Nicely made straps and bolts are very useful in connection with a machine made with a T slot, as a large amount of work that is strapped to a planer table can be fastened in the same manner to the milling machine.

All such fixtures and contrivances should be well made, bolts should be turned and nicely squared under the head so that the bearing on the under side of the T slot will not become battered and out of truth; straps should also be milled, especially where they bear on the platen. Blocks for holding screw dogs for fastening pieces down, and in fact, a great many little inexpensive fixtures and attachments can be thought out that will pay more than double their cost every year.

I mention these fixtures because the plain milling machine with a few such tools and fixtures can be used for work where at present only the Universal Milling Machine will answer.

Of course, the greater variety of work that can be done on the Universal Machine will make it preferable for tool work, but I am speaking of a machine that is of the greatest utility for small shops where the money is yet to be earned before an expensive Universal Machine can be purchased.

Having described some of the what might be called general utility fixtures, I propose to show in the papers to follow some of the methods of doing work with them, and should any of the readers of these articles have any different way of doing the same thing, everybody will be benefitted if they will make them known through the same channel.

David Lennox, of Marshalltown, Ia., has patented an ingenious device for tapping gas and water mains. He secures a drill, a tap and a threaded plug in an air-tight box which he clamps to the pipe to be operated upon. The hole can then be drilled, a thread tapped in it and a plug inserted, the successive operations not requiring the shutting off the water or gas. The rig ought to prove very convenient in numerous cases where shutting off water or gas is troublesome and expensive.

How an Important Invention was Suggested.

The firm of Seymour & Whitlock have been for years engaged in the business of making stamping presses. They had devoted special attention to the perfecting of their machines, so that accurate work might be produced. Their presses had become noted for accuracy of work, and one day a Western manufacturer walked into their shop and wanted to examine the most accurate working press they could produce. One of their best was in the shop newly finished, and it was examined. The Western man praised the press, and said it was good of its kind, but was useless for his work, as he wanted a machine that could be regulated to the one-thousandth part of an inch. A machine that could be regulated to that degree of accuracy had not then been made.

After the Western man left, Mr. Seymour kept planning some method of producing a means of regulating a movable punch, so that it would do its work as close as a micrometer gauge could measure. All sorts of schemes were digested and abandoned. One day while cogitating over the subject he happened to catch the chain of a differential pulley block as a rest, and as it ran through the block it occurred to him that this was the line to work on for making an accurately-gauged punch movement. After much thought and experiment, the principle the vernier calipers work on was determined upon as a means of regulating the movement of a reciprocating punch.

Panama Canal Machinery.

The Cooke Locomotive Works at Paterson, N. J., are building a group of locomotives for the Panama Canal Company to be employed in the construction of that great enterprise. Most of the engines are demoninated as "switching," but they will be employed principally in the handling of construction material.

A company in Lockport, N. Y., interested in contracts connected with the Panama Canal, are building derricks and construction plant, part of which has been shipped to Colon. Considerable preliminary work has been done at the Colon end of the Panama Canal. A large embankment has been formed on the bay to provide facilities for wharfage and healthy dwellings. The contractors are now getting ready to commence operations on the canal excavations, and a large force of men and great quantities of material are on the ground. Much trouble has been experienced from sickness, but it is expected that the improved sanitary conditions effected by the embankment will make the location more healthy.

Mr. R. M. Van Ardsdale, proprietor of the *National Car Builder*, who has returned from an extended tour through the Western States, gives an encouraging account of the condition of business on the Pacific Coast. Mr. Van Ardsdale has been over the Northern Pacific Railroad, and he considers there are excellent prospects for settlers all through the new regions opened up by that new avenue of travel. From the Pacific to St. Paul the whole route is through a farming or grazing country. The railroads having headquarters beyond the Rocky Mountains are compelled to manufacture their own supplies so far as they have the raw material, because the expense of transportation of goods from the East makes them enormously costly. A case in point was mentioned where a lady bought a rocking chair in New York for about $15, and its cost of freight to Sacramento was $45. The Central Pacific Railroad shops in Sacramento make nearly everything needed in operating the road. Their list of productions extend from locomotives to fire brick. The shops are a complete manufacturing mart, every article got out being of first-class quality. To attain this result the whole country has been ransacked for the most skillful workmen to supervise every department. They produce springs equal to those made by Eastern houses which follow that business as a specialty, the character of their varied details of car furnishing compares favorably with anything they can buy from old established houses. The locomotives built under the direction of A. J. Stevens, the general master mechanic, are not excelled in finish, durability and economy by anything made in our best locomotive works, and these engines are not only built in the company's shops at Sacramento, but the material also is nearly all worked out there. Their facilities extend from making the pressure gauge to forging the driving axle; and their capacity embraces within its range rolling boiler sheets, casting driving wheels and planning new valve motion. That appears to be much of a self-maintaining establishment.

Webb's Compound Locomotive.

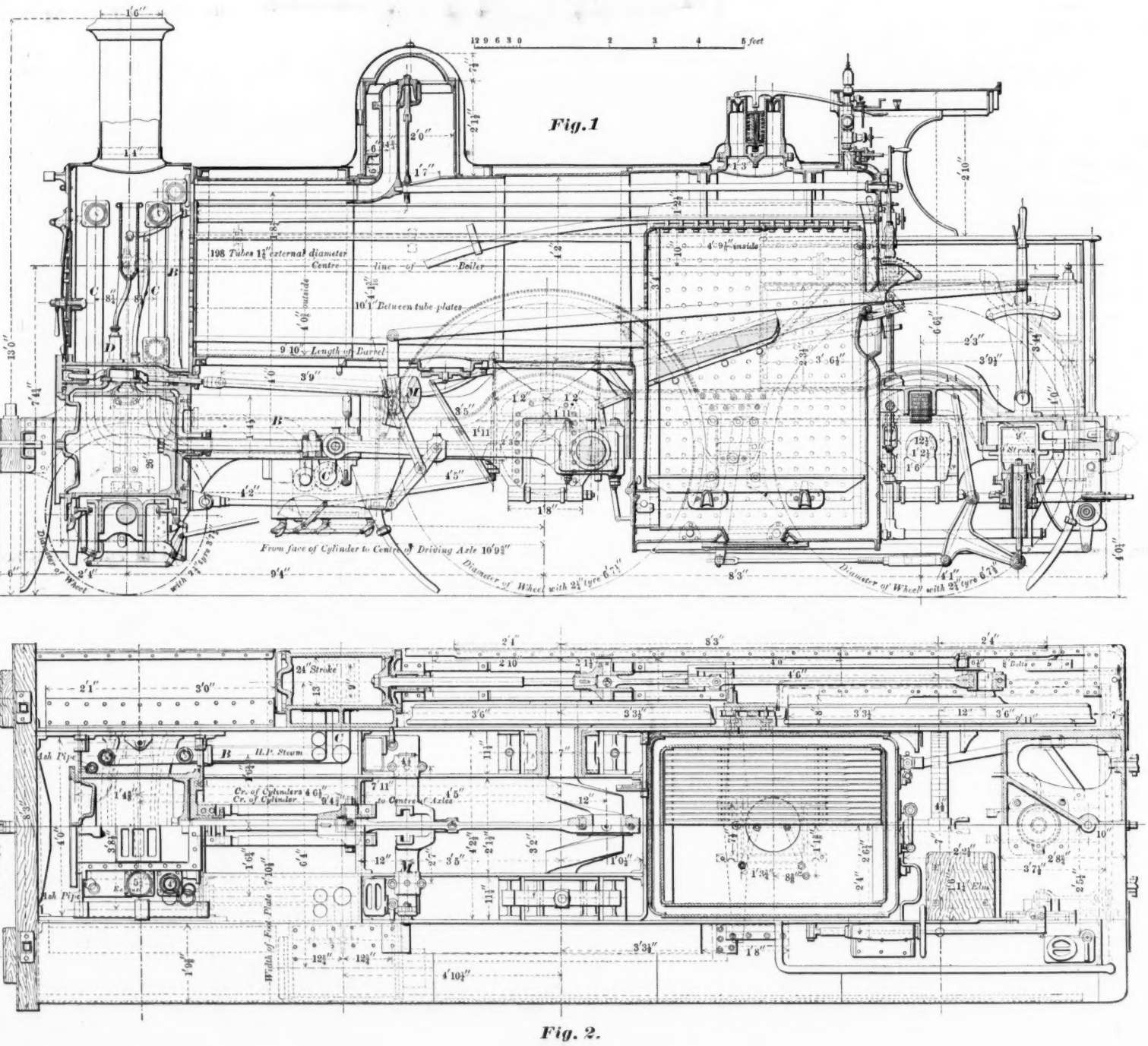
We reproduce from *Engineering* two engravings showing the construction and details of a new compound locomotive engine, invented and built by Francis W. Webb of Crewe, England, vice-president of the London & North Western Railway. For the description of the engine we select particulars from a paper read by Mr. Webb at a meeting of the Institute of Mechanical Engineers, and reported in *Engineering*.

After referring to certain experiments made by M. Mallet in France, with compound locomotives, Mr. Webb expressed the belief that the principle of compounding was a desirable improvement. He commenced experimenting with that type of engine about five years ago, first with a converted two cylinder locomotive, and later with an engine built specially to embrace certain changes which he had introduced. This engine had three cylinders, two for high pressure steam and the third for expanding the exhaust steam from the other two. This engine was put to work running the Scotch and Irish limited mails—very fast trains. While at work it made a daily run of 319 miles. The engine throughout has proved itself to be very steady while running, which is no doubt due to the arrangement of the cylinders; the engine being practically balanced and having no coupling rods, is enabled to run at very high speeds.

These experiments having proved the principle to be correct, Mr. Webb proceeded to build larger engines after the same design, in which he made further improvements in details. The engine illustrated is one of the last constructed, and has two high pressure cylinders thirteen inches in diameter, and one low pressure cylinder twenty-six inches diameter, the stroke in both cases being twenty-four inches. Figure 1 is a section through the low pressure cylinders, and Fig. 2 is a sectional plan. The two high pressure cylinders have their steam chests placed underneath the cylinders in order to allow the valves to fall from their seats so that there is no wear when the steam is shut off. These two cylinders are attached to the outside frame plates immediately under the footplate about midway between the leading and middle wheels, and are connected through their piston rods and connecting rods to the trailing wheels. The low pressure cylinder which has its steam chest on the top, is placed directly over the leading axle, and is carried between two cross-steel plates, one at either end, securely fixed between the main frames; its connection rod lays hold of a single-throw crank on the axle of the middle pair of wheels.

The steam is supplied through the regulator in the dome, Fig. 1, to a brass T pipe on the smoke-box tube plate, and thence by 3″ copper steam pipes *B*, first runuing parallel to the tube plate, then through the back plate that carries the low pressure cylinder, and between the plates of the inside and outside frames to the steam chest of the high pressure cylinders. The exhaust steam from these cylinders is returned by two 4″ pipes *C*, running parallel with the high pressure pipes through the back plate that carries the low pressure cylinder and into the smoke-box; following round the curved sides of the smoke-box nearly to the top, each pipe passes across to the opposite side and enters the steam chest of the low pressure cylinder through passages in the cover. Thus the exhaust steam becomes superheated in these pipes by the waste gases in the smoke-box, while the large capacity of the pipes themselves obviates the necessity for a separate steam receiver. The final exhaust escapes from each side of the steam chest of the low pressure cylinder into the blast-pipe and thence to the chimney in the usual way, the only difference being that there are only half the number of exhausts for urging the fire, compared with an ordinary engine; yet the compound engine steams very freely and has a blast nozzle $4\frac{7}{8}$″ diameter compared with $4\frac{1}{2}$″ in engines of ordinary type.

The steam chest cover of the large cylinder is provided with a relief valve *D*, so adjusted that the pressure admitted may never exceed 75 lbs. per square inch; and a small pipe, which is connected with the low pressure steam pipe and carried back to a gauge inside the cab, shows the actual pressure of steam being used in the large cylinder.


198 Tubes 1¾″ external diameter
Centre line of Boiler
Between tube plates
Length of Barrel
4′ 9½″ inside
4′ 0″ outside
From face of Cylinder to Centre of Driving Axle 10′ 9½″
Diameter of Wheel with 2¼ tyre 6′ 7″
Diameter of Wheel with 2¼ tyre 6′ 7″
Diameter of Wheel with 2¼ tyre 6′ 7″
24″ Stroke
B H.P. Steam
Ash Pipe
Cr. of Cylinders
Cr. of Cylinder
to Centre of Axles
Width of Foot Plate
Fig. 1
Fig. 2.

The valve motion of the low pressure cylinder differs slightly from that of the high pressure. The travel of the valve in full gear is $4\frac{1}{2}$″, lap of valve 1″, lead $\frac{3}{16}$″; the port opens 1″ for admission and is closed at 75 per cent. of the stroke, and the exhaust closes at 93 per cent. of the stroke. The sizes of the ports are, for steam 2″x16″ and for exhaust $3\frac{1}{4}$″x16″.

The reversing gears of the high and low pressure cylinders are designed to work independently of each other, and no inconvenience has been experienced by this arrangement; they could if desired be connected, but this would mean complicating the parts while no material advantage would be gained.

With regard to the expansion at which the engine is worked, in practice the low pressure cylinder is kept nearly at full gear, while all the expansion is done in the small high-pressure cylinders, so that no more steam is used than is absolutely necessary to do the work.

Arrangement is also made whereby steam direct from the boiler can be admitted to the low pressure cylinder, which is useful for warming up before starting.

The valve motion adapted for this engine is the Joy, which does away with all eccentric rods and considerably reduces the number of working parts per cylinder, as well as the weight of the valve gear. The total number of moving parts for the three sets of valve motion in the compound engine is twenty-nine and their total weight 284 lbs., while the number of working parts in the two sets of valve motion in an ordinary standard engine is twenty-four and their weight 793 lbs.

The high-pressure slide valves are of the Trick or Allen type; they have a travel of $3\frac{1}{8}$″ in full gear. The lap is $\frac{3}{4}$″ and the lead $\frac{1}{8}$″, the port opens $\frac{3}{4}$″ for admission, and closes at 70 per cent. of the stroke. The sizes of the ports are, steam $1\frac{3}{8}$″x9″, exhaust $2\frac{1}{2}$″x9″.

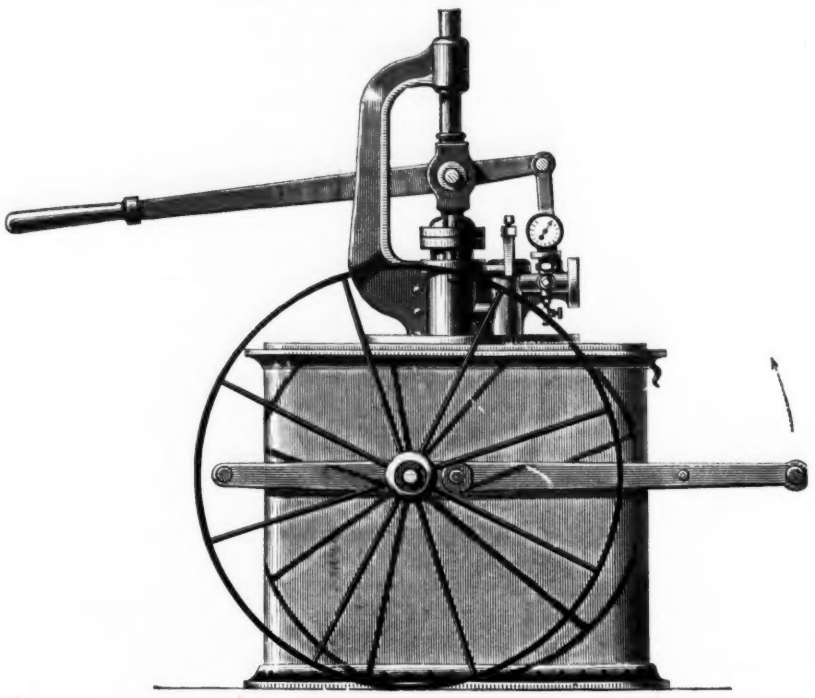
One of the principal features in the new engines has been the adoption of a boiler with the water space of the fire-box carried under the grate, the space between it and the fire bars forming the ash-pan. The object is to do away with the rigid foundation ring which is always a source of trouble; to obtain better circulation for the water; and to prevent the lodgment of dirt on the sides of the fire-box where subject to the most intense heat. A flanged mouthpiece similar to that of the fire door is formed in the center of the water space, and covered with sliding doors worked from the footplate, so that the ashes can be easily removed or dropped; while any sediment that may collect in the water space can readily be removed through wash-out plugs in the sides

of the fire-box, there being a clear passage from side to side when the covers are taken off. The mouth of the ash-pan is made of such a width that the tube plate can be taken out and replaced by a new one without disturbing the other parts of the fire-box.

The forward part of the engine is carried by a single pair of wheels which are provided with a radial box having a lateral motion of 1¼″. The driving wheels are 78″ diameter, and the engine has a total wheel base of 17 ft. 7 in. The fire-box presents a heating surface of 103.5 feet, and the tubes, 198 in number, give 980 feet, making a total heating surface of 1083.5 square feet; the grate area is 17 feet.

Test Pump for Boilers and Pipes.

We herewith illustrate a force pump specially designed and manufactured for the testing of boilers and pipes by hydraulic pressure. In a great many shops where the testing of boilers and pipes has to be done, the appliances for performing this important work are of the crudest and most perfunctory character. The consequence is, that valuable time is often wasted in doing an operation which ought merely to be the work of a few minutes, and when it is done the record is worth very little. A convenient pump like that here shown soon pays for itself in the saving of workmen's time effected. The pump cylinder is made of cast iron, the lever of wrought iron, and the valves of steam metal. Two pistons are used, one working within the other, the larger piston being applied in filling up the boiler or pipes, while the small one comes into service when the point of testing is reached. Changing the action of the pistons is done by simply moving a wrought iron pin. The pump is mounted on a sheet iron tank which is fitted with wheels and frame that carry it readily to the points where the testing is to be done. It is manufactured by Schaffer & Budenberg, 40 John street, New York.



Test Pump for Boilers.

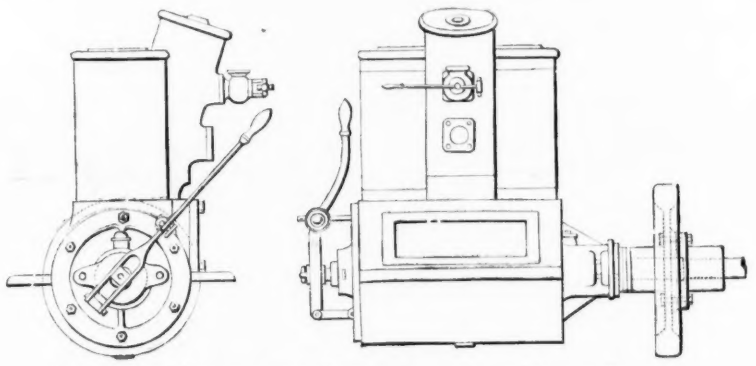
The Steam Yacht Topsy.

The use of small steam yachts for pleasure purposes is fast growing in popular estimation in this country. As in a pleasure yacht speed and compactness are important matters, it is essential to get large engine power in small space and weight, which, coupled with good lines on the hull and a properly proportioned screw, will bring about high speed. The old type of marine engine is very generally considered as not suited to the purpose, the weight for a given power being too great from the fact that it is impracticable to get sufficient speed, in revolutions.

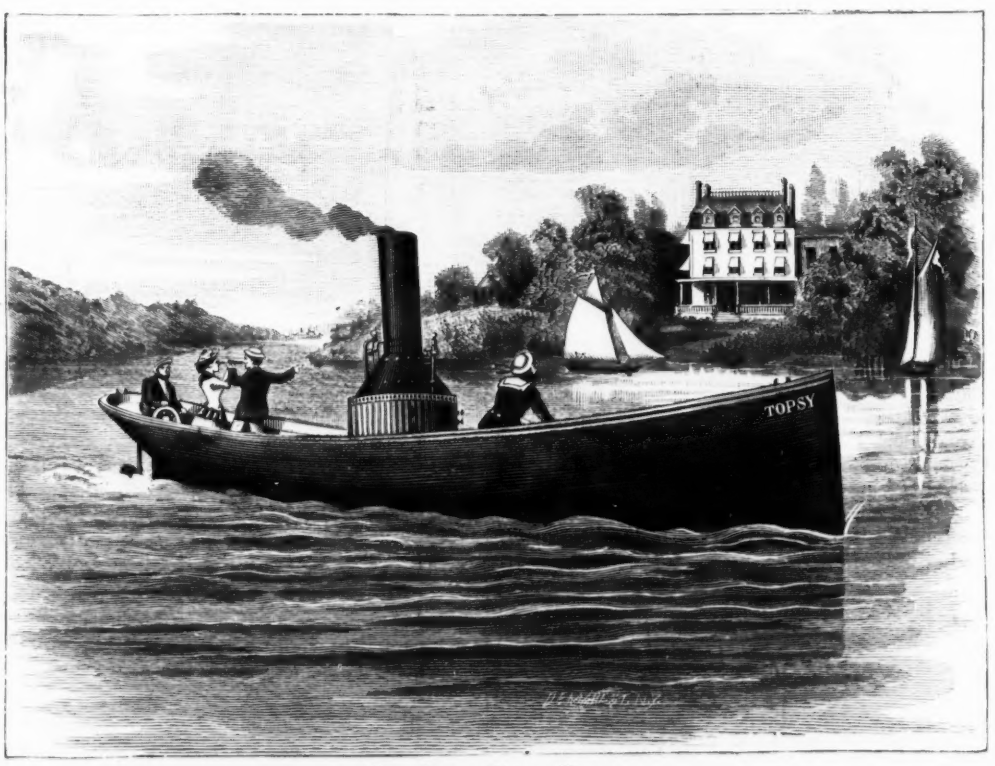
The engraving represents the first steam yacht built by the Westinghouse Machine Company, Pittsburgh, Pa. Her dimensions are 34 feet 6″ over all, and 5 feet 6″ beam. The engine is a 5″x6″ Westinghouse marine; boiler plain vertical, 3 feet diameter and 4 feet high, with 1″ tubes 20″ long; double cone and stack. The screw is two-bladed, 28″ diameter and 28″ pitch. The pitch of screw is much below the usual practice, being made to correspond with the high speed of the engine, which, with 80 lbs. boiler pressure, is from 375 to 400, and with 120 lbs. upwards of 500 revolutions per minute. In a trial over a measured mile this engine has propelled the boat at a speed of twelve miles per hour, which it is believed will be increased to fifteen when (as is the intention) a 6″ engine is put in in place of the 5″. The engine exhausts into the smoke-stack or into a keel condenser at the option of the engineer.

The boat is supplied with underneath tanks throughout, the tanks being divided into compartments and used for adjustable water ballast. An ejector, the suction of which reaches down into the keel condenser to the stern post, provides for entirely freeing the condenser of accumulated water before starting, thus enabling the boat to be started from the dock much quicker than would otherwise be possible.

The small outline cuts represent the Westinghouse engine as adapted to marine purposes, which, we are informed, has during the past season been applied to a number of launches for various purposes, for which its high rotative speed particularly adapts it.



Outline of Westinghouse Engine Adapted to Marine Purposes.



The Steam Yacht Topsy.

Death of a Well-known Engineer.

John C. Trautwine, the well-known civil engineer, died in Philadelphia on the 14th inst. He was born in that city March 30, 1810, and was consequently seventy-three years old at the time of his death. At the age of eighteen he commenced his career in the office of an architect, and by industry and natural ability rose rapidly in his profession. He was engaged during his life upon many important engineering projects, both at home and abroad, amongst others the construction of the Canal Del Dique, in New Granada, and the Panama Railroad. As an author he was favorably known, his "Civil Engineers' Pocket Book" being considered authority, and from its clearness and conciseness is extensively used both in and out of the profession. Mr. Trautwine was an active and valued member of some of the most important scientific societies.

The Hartford *Times* has brought from obscurity a mechanical prodigy named Chas. R. King, who seems to be the veritable King Jack-of-all Trades. Owing to the dignity of the sponsor we shall not suggest the finish of that old aphorism about men who dabble in many occupations. Owing to the possession of an "accurate eye and a mechanical head" this genius has, he claims, learned in succession the trades of blacksmith, carpenter, cabinetmaker, glass-cutter and grinder, shoemaker, harnessmaker, wheelwright, machinist, mathematical instrument maker, pattern maker, clockmaker, cooper, carriagemaker, gardener, moulder and plumber. Beside that long list of trades, Mr. King is reputed to be a good musician and rifle shot.

As the interviewer did not mention that the man of many trades had attained antediluvian age, we would be disposed to believe that he had only worked at the multifarious occupations mentioned. We have often met men calling themselves machinists who learnt the business by laboring round a machine shop for three months. And we have all heard of the laborer who described himself as a mason after he had carried the hod two days. It is astonishing with what lightning rapidity some men acquire difficult trades when their own estimate of learning is accepted, but when such men fall under the supervision of a sharp foreman they generally happen to forget their art quicker than they acquired it.

In many parts of the country there are natural gas wells which supply a volume of gas that might be applied successfully to industrial purposes. These wells are not confined to the oil regions alone; they exist in many places where no indications of oil or coal have been met with. A successful method of using the gas from such a well has just been inaugurated at the Panhandle Glass Works, Wellsburg, W. V. The company have commenced carrying on the flattening department of their works by means of natural gas. The glass produced by this method is of a superior quality, being free from the opaque taint made by sulphur where coal is employed.

LETTERS FROM PRACTICAL MEN.

Sediment in Upright Tubular Boilers.

Editor American Machinist:

In looking over a copy of your paper dated May 26, 1883, I noticed your question and answer No. 192, wherein "H. M.," of Providence, R. I., states that he repaired an upright boiler, which was tight under a cold water pressure but leaked badly around the lower ends of the tubes as soon as a fire was started. He asks you if this was caused by unequal expansion, and you reply "yes." So far so good; but you don't go to the root of the matter. Will you allow me to state my experience in a similar case? Some years ago I received (in partial payment for a larger new boiler) a second-hand vertical boiler, which was apparently in excellent condition. I tested it to my satisfaction, examined the water-legs and found them free from sediment, and also examined the crown sheet (or lower tube head) as far as possible. Then I sold it under a warranty. Fortunately, it did not go out of the city, but was set up, passed by the local inspector, a certificate granted, and the purchaser commenced to get up steam; when, lo and behold! the tube joints leaked so they put out the fire. I had the tubes re-expanded and made tight under 150 lbs. hydrostatic pressure, and then fired up, with the same result. I could not understand it, and consulted several eminent firms of boiler makers, who could give me no assistance. I then took the boiler back and substituted another. Then I commenced to study over the matter. It was plain that the effect was due to unequal expansion, but *why* did this unequal expansion exist?

After considerable thought I reasoned the matter out in this way: It was evident that the tube head expanded more rapidly than the tubes, thus making the tube holes too large for the tubes and allowing the water to escape between them. As both received the

same amount of heat, one must get rid of it faster than the other. The tubes *must* be at least partially protected by the water, while it was possible that the tube head might be covered by scale in among the bases of the tubes. Of course the tubes would be surrounded by the same scale, or sediment, but the metal being a good conductor of caloric, the heat would run up the tube to a point above the sediment and then be absorbed by the water, thus keeping the ends of the tubes comparatively cool, while the head itself was constantly becoming more heated. It is well known that the sediment is always heavier in the center of the crown sheet of an upright tubular boiler, and from there tapers off towards its edges, making a sort of "obtuse cone," if I may be allowed the expression.

Well, the fact that the center tubes leaked the most supported my theory as to the presence of deposit, and I accordingly took out the central tube carefully and found 4″ thickness of friable scale or deposit, such as would not have attached itself to a vertical sheet, but, having been deposited among the tubes, could not find its way out again.

I then marked out circles of tubes throughout the head, removed the central tube in each circle (or about 20 per cent. of the tubes in all), cleaned the head with a chisel bar, put in new tubes, resold the boiler, and it has been giving good satisfaction ever since. This deposit of sediment among the tubes seems to be a malady among upright tubular boilers, for which there is no reliable remedy. Hand-holes are nearly useless, whether the tubes are arranged in rows, circles, or staggered. I have obtained the greatest relief by leaving out the central tube, and then running a pipe of the same size through the upper head to within about ¼″ of the lower head. This pipe is to be connected with the city water or a tank, or other means of getting a "head." When the boiler has been emptied (I do not approve of "blowing off"), and the hand-holes are open, the water can be turned on, and if the end of the pipe has been cut off square, the water will be thrown out between its edges and the lower head with considerable force, in a circle, and go far toward washing the sediment off the tube sheet into the water legs—from which latter, of course, it can be easily removed. Care should be taken not to leave the supply valve (or cock) of this pipe open when getting up steam, or the boiler will empty itself as soon as the steam pressure exceeds the head. This explanation is four times the length I intended, but if you publish it, it may save some one all the trouble I was put to, because I had to manufacture my own experience instead of having had the benefit of the easier way of acquiring it from a live mechanical newspaper.

E. E. Roberts.

107 Liberty street, New York.

Cast-Iron Columns for Gauge Cocks and Water Lines.

Editor American Machinist:

As the subject of steam boilers and their inspection are being discussed, a few words about gauge-cocks and water glasses may be of interest. My attention was called a few days ago to a boiler that was on a cross street not far from Broadway, and surrounded by several of the leading hotels. A little incident that happened me not long ago proves to my mind that this boiler is unsafe, and wondering if there were many more like it around, I thought I would take a look at those I could see easily, that is without hunting up proprietors or rumaging around dark cellars and corners, in which they are generally located. I found four large ones, three of them in machine shops, and two out of the four had the cast-iron column to which the glass and water-cocks were attached, and which is what came so near getting me into a scrape.

Now, these boilers are carrying from 60 to 80 lbs. of steam, and are only a small portion of those that could be found in the same condition, as I have seen six within a few weeks.

As water-cocks are the only means that I know of for telling, with certainty, how much water there is in the boiler, they should receive the best of care and be used every day; that they do not get it is seen by going into almost any large boiler room, and by looking up seeing them so high overhead that they cannot be reached except with a step-ladder or a balloon. Alongside is to be seen the water-glass. The boiler-tender depends mostly on this, blowing it out occasionally when he thinks it needs it.

The cast-iron column with the water-cocks on one side, water-glass on the other and steam-gauge above seems to be coming into general use, but why, I don't know, and would rather take my chances at guessing at the water in the boiler than use it. This column is connected to the boiler above and below the water-level, and without a valve or anything between it and the boiler for shutting off water or steam.

Why I object to it the following will show, and I hope engineers and inspectors will understand the reason:

I set up and run an 80-horse power boiler with a water-glass (without a cast column) on one side and three gauge-cocks on the other. There was a water-glass with a cast column belonging to another boiler that I concluded to put in the engine-room about 1 or 1½ feet from the boiler. I did so, and found the glass worked all right for abont three weeks; then one morning I noticed it fill gradually 4″ or 5″, then fall; so I went over close to it and noticed the water appeared to be formed by the condensation of steam in the glass. I thought the bottom valve was choked, so I blew it out several times, but finally gave it up, shut it off, and run with the other glass and cocks. I took it off at the elbow, just under the cast column, and found it solid with sediment. I put the glass back again, but without the casting, and had no trouble afterwards.

I think I discovered something wrong just at the time the pipe was about choked, and when 4″ or 5″ of condensed water gathered above, it was weight enough to break through the sediment below and gain the level in the boiler.

Now, supposing I had had the cocks screwed in that column. It is evident they would show water by opening them, and had an accident happened, I could have sworn that there was water in that column. But how about the boiler? Wouldn't there have been a possibility of a few flues being red-hot? I think so.

These boilers I have mentioned have that same liability, and have a very poor show should the under pipe get clogged, and a worse one should the pipe get filled, so that the condensed water would just drip through the sediment at about the same rate that it condensed above.

If gauge-cocks are to be used to show the water in this column, then put them there; but if they are intended for the boiler, then by all means put them where they belong. I don't feel competent to handle this subject, but the number of cast columns is daily increasing, and many makers put nothing else on their boilers.

If this incident will in any way call attention to a fault that can be remedied and aid in preventing the use of such columns, especially without they are provided with globe-valves or cocks to clean them out, I shall be satisfied.

P. C. Forrester.

Two Methods of Casting Flanged Pipe—Mending Broken Crank Shafts and Making New Ones—Slide Valves and Seats with Equal and Unequal Wearing Surface—Seeing Right and Doing Wrong.

Editor American Machinist:

Your paper for September 22d reminds me of what I have said before; that is that I hardly go through a number without coming across articles to which I have a desire to reply—a desire which, in some cases, it is difficult to resist. So, if your readers think some one is making himself too numerous, they may take consolation from the fact that he fights against his inclinations.

It seems my friend Durfee (who, by the way, I found years ago to be a regular resurrectionist in the way of turning up old inventions) finds that some antiquated Frenchman has been stealing my thunder and casting flanged pipe.

It may be entirely a fallacy, but I have a notion that the slight difference between my plan and the Frenchman's is just the difference between limited success and failure. On the first presentation of the scheme, every one around the premises wanted each chill made in halves. "It would be so handy to set them, you know." But I believed then as I do now, that nothing but failure awaits the efforts of the man who travels that road. The rapid crumbling of the corners of the chill at the joint, and the wear of the steady pins, would soon demoralize the results.

Frank Gleason's description of his method of repairing a broken crank shaft represents just one of those jobs that show the value of a good man in times of difficulty, and will furnish some of us sometime a good text for an article showing why one man doing the same amount of the same kind of work, and equally well as another, is not necessarily worth just as much money.

The method he describes is very similar to a method described to me by one of the foremen at the I. P. Morris Works, as adopted by them in the construction of a double crank shaft 16″ in diameter, except that in putting in the final pins they used pressure in the place of shrink fits.

In shrinking the throws of the cranks to the shaft ends, the throws were heated by bedding them in the foundry floor and pouring melted iron around them. In forcing in one of the crank pins, they reached the limit of their jack before the pin came to the shoulder, and by simply applying a stream of hot water from the boiler to the throw, it was expanded sufficiently to allow the crank pin to be forced home.

Your correspondent signing himself "Ferrum" points out what I have for years believed to be the main, if not the entire, cause of valve seats wearing concave. It is a consolation to know there is one other fellow who believes it, for, while I have been preaching the theory of "equal length wearing surfaces" for all sliding surfaces for years, I never made any converts, or at least none who were sufficiently converted to adopt the principle. In fact, if I were to appear before a confessor, I should be compelled to admit that I do not live up to my own professions. Twelve or thirteen years ago I built an engine with the cross-head and guides of equal length, and, though worn considerable, they are as straight to-day as a proof staff; and yet we are building engines with the guides longer than the cross-head, and they wear concave just like other people's, only not one-quarter as much so as some. I know they would be better and cheaper to make if we should cut the guides off to the proper length, but it is such a difficult thing to do right when it is against the fashion that probably we shall keep on in our wrong-doing.

Some say that it is impossible to design a slide valve to meet certain requirements and keep the wearing faces equal. I should like to be swamped on that problem some day, and should be interested in seeing a valve working on a seat of equal wearing surface that had worn the seat concave, or an unbalanced slide valve which had run some time that had not worn the seat concave if the two faces were not of equal length.

Syracuse, N. Y. John E. Sweet.

Leveling Steam Pipe with a Rubber Hose.

Editor American Machinist:

In your issue of September 1 appears an illustration and explanation of "McDonald's Hydrostatic Leveling Instrument." This device is another example of the adage, "There is nothing new under the sun." So long ago as 1874, while following the business of steam heating, we had a contract for heating St. Mary's Church at New Haven. The apparatus consisted in part of a system of steam pipes under the seats. The stained-glass windows admitted only a "dim, religious light," and consequently we were greatly troubled to see our work, and, moreover, each pipe must be leveled relatively to all the others. After trying in vain surveyors' instruments and other means, I finally devised and effectually used exactly the device now set forth as "McDonald's Hydrostatic Leveling Instrument," minus some of the useless details.

My rubber tube was ten feet long, and I can bear witness, as can all my workmen, that for the purposes I used it for, and for many others I have since had occasion to use it in, it was very effective. If the water in the tube is colored red or black, it is still more convenient.

H. B. Brown.

Fast Melting of Iron.

Editor American Machinist:

In the Blakeney Foundry, where the Blakeney cupola furnace is manufactured, the melted iron begins to run in from three to five minutes, and the workmen begin to pour the iron in from eight to ten minutes from the time of putting on the blast. Can any furnace show a better record? This is an every-day achievement in the above foundry.

Blakeney Foundry Company.

Springfield, O.

Boiler Feeding.

Editor American Machinist:

In the matter of economical boiler feeding discussed somewhat of late, I feel constrained to reply to the letters of Messrs. Greaser, Thought, *et al.*

In the first place, they evidently failed to comprehend the main argument of my letter, viz., that in ninety-nine cases out of one hundred the saving of the waste heat of the exhaust was of much greater importance than the method employed to force the water into the boiler, the actual power required being quite insignificant.

Mr. Greaser says my figures stop; inferring, I suppose, that I had not proven my argument.

I will not attempt to demonstrate the matter in a more comprehensive way than before, because I don't know how.

I only ask him to show wherein my figures are not correct.

As to the power required to run Mr. G.'s pump, I will admit that I cannot tell it without some data, such as the quantity pumped, height or pressures involved, etc., etc. The finest way would be by indicating the engine with and without the pump attached. But if that is too much trouble, the following rule ought to certainly cover the case:

Multiply the weight of water in pounds fed to the boiler per minute by the head in feet corresponding to the boiler pressure, added to the height of lift. This gives the foot-pounds per minute, which divided by 33,000, will give the theoretical horse-power. Here the figures must stop and guess-work begin, as size, length and character of pipes, condition of pump, valves and packing, all influence the result. But for conditions at all fit to tolerate, double the theoretical power ought to be sufficient.

The heat or steam required for an injector is quite as easily ascertained by multiplying the rise of temperature by the pounds of water drawn into the injector per minute, which gives the units of heat supplied by the injector over and above that contained in the condensed steam, which is returned to the boiler. The pounds of steam necessary to supply an equal amount of heat can be ascertained by dividing this total by the units of heat required to evaporate one pound of water from the temperature of the feed and under the pressure of the boiler. There will also be some loss of heat by radiation and by conversion into work, but not enough to effect the results materially.

That the power required for feeding boilers generally is "quite insignificant" seems so self-evident to any one who has given the matter any attention that I gave no figures to prove it; but for Mr. Greaser's benefit I will try to make it plain now.

It has been found by actual observation that steam engines require from twenty to sixty pounds of feed water per hour per horse-power, according to circumstances; therefore, to assume as average practice a rate of 40 lbs. per hour per horse-power ought to be fair. We will also assume boiler pressure as 80 lbs.

Eighty lbs. pressure will raise water 185 feet. Forty lbs. × 185 feet = 7,400 foot-pounds per hour, or 124 foot-pounds per

minute. One horse-power = 33,000 foot-pounds. Therefore, it requires theoretically $\frac{1}{33000}$ of the power of an engine to feed its boiler. But under average circumstances we will double this amount for friction, etc., which gives $\frac{2}{33000}$, or about $\frac{3}{4}$ of 1 per cent., which really does seem insignificant when compared to matters of from 5 to 15 per cent.

It also appears plain enough for even Mr. G.'s comprehension that $\frac{1}{8}$th or even $\frac{1}{20}$th of the heat supplied to steam will be quite sufficient to do $\frac{1}{133}$ of the work required of that steam and leave quite a margin of power for business.

Mr. Thought shows that he gave my argument no thought when he says, "The injector can of course send its delivery water through the exhaust heater and obtain all the advantages of that method of heating." Now it is manifest that the heat saved is measured by the heat added to the feed water.

With a power pump the water may be fed say at 50° and heated to 200°. With the average injector it is delivered at 150° and heated to 200°. In the first case 150° is the amount saved, against 50° in the case of the injector. The advantage in favor of the pump are 3 to 1.

The use of a regulation direct-acting steam pump, whilst better than the injector, is simply doing the work with the crudest and most wasteful form of an engine, that ought to be done with the main engine driver, which must be poor indeed if it could not do the work with one-third the steam.

The common slide-valve engine will pump 100 lbs. of water against 80 lbs. pressure with a consumption of .8 of a pound of water, and a really good engine will do it with .3 of a pound or less, as against Mr. G.'s figures of 2.6 lbs. required by a *good* steam pump.

Circumstances sometimes prevent the convenient application of engine power to driving the feed pump. But except in such cases, which are rare, it is just as important to do the pumping by an economical power as it is to do any other part of the work in hand economically.

When a larger quantity of water is required than that consumed by the engine alone, it is still more important to have it properly pumped, and heated from waste steam or chimney gases.

The chimney heater or economizer is only another application of the same principle, and I would say in reply to Mr. Thought that if he only adds twenty degrees by means of his chimney heater the results should not be considered satisfactory. I have heated water in that way regularly to over 300°, adding fully 100° to the temperature after leaving the exhaust heater.

F. B. Rice.

Dunkirk, N. Y.

Melting Iron in a Minneapolis (Minn.) Foundry.

Editor American Machinist:

In your issue of September 15, Mr. West furnishes some very valuable data concerning the working of cupolas in four different foundries in Cleveland, Ohio, and at the close of his article he says: "I would like to see as commendable a report presented from the use of all coke in any similar common style and sized cupola."

Now, by way of comparison, I submit to the consideration of your readers a report of the working of the cupola in the North Star Iron Works, Minneapolis, Minn.

It is a perfectly straight cupola, being the same diameter from hearth upward to its full height. Its diameter inside the lining is 35″; has four tuyeres 3″ diameter on the inside of the lining and 5″ diameter at the shell. There is no wind box. The tuyeres are 12″ from hearth after sand bottom is put in; height from hearth to charging door, 7 feet. We have a No. 5 Sturtevant fan running 2,800 revolutions per minute. For heats up to 8,000 lbs. we melt with all coke; for heavier heats we use a small percentage of coal. Our method of charging is as follows:

For heats up to 8,000 lbs. we put on bed 450 lbs. of coke, on top of this 1,800 lbs. of iron. We then charge up with 600 lbs. charges, using 50 lbs. of coke between the same. For a flux we use fluor-spar.

Let us now compare Mr. West's four cupolas with that of the North Star Works. These works make a specialty of engine work, saw-mill and flouring mill machinery and all kinds of jobbing.

Taking a heat of 8,000 lbs. of iron and figuring from Mr. West's data, how much fuel the Cleveland (Ohio) foundries consume in melting that amount, we have the following:

		POUNDS.
Cleveland.	Cuyahoga Iron Works, coal and coke	1,428
	Globe Iron Works, coke	1,410
	Eclipse Iron Works, coke	1,508
	Viaduct Iron Works, coal and coke	1,878
North Star Iron Works		960

Charging as above.

Time of melting above heat in North Star Works, 1 hour from the time the blast is put on.

I may say here that the iron resulting from this practice is quite hot enough for our class of work, and is in all respects satisfactory, losing no work through dull iron.

For heats of 7 or 8 tons we alter our method to some extent.

For the bed we use 300 lbs. of coke and 200 lbs. of coal, and instead of 50 lbs. we use 60 lbs. of coke between the charges; taking a heat of 8,000 lbs. we have therefore the following record:

		POUNDS.
Cleveland.	Cuyahoga Iron Works, coal and coke	2,461
	Globe Iron Works, coke	2,290
	Eclipse Iron Works, coke	2,457
	Viaduct Foundry, coal and coke	2,889
North Star Iron Works, coal and coke		1,900

Comment is unnecessary. The above facts speak for themselves. Minneapolis being so far away from the Pennsylvania coal fields may have something to do with teaching us how to economize in fuel.

P. L. Simpson.

Minneapolis, Minn.

An Engineer's Views on Boiler Explosions and Inspection.

Editor American Machinist:

Your remarks on the Riverdale explosion, closely followed by the verdict of the jury, deserves more than pasing attention. As usual, the engineer was condemned. The present system of boiler inspection is rather loose, especially when it allows a man to hold the office of inspector who, in order to make an inspection of a boiler, simply sticks his head in a manhole, and then makes out a certificate that the boiler is perfectly safe to carry a certain pressure of steam. I will not say that that inspector's failure to go into the boiler was the cause of the Riverdale's explosion; but I do say if he had gone into the boiler, as was his duty, he might have discovered something that would have led to an attempt to head off a threatened danger.

I remember a case where two boilers were inspected by the firm that owned them simply paying to the so-called inspector $7.50. An inspection paper was filled out and handed to the engineer. In such a case, had an accident happened to these boilers, I think the firm should have been held responsible, as the boilers were inspected in this manner in order to save time.

We have many skilled engineers, and many otherwise. It is very common for the owner of a steam boiler to look for a skilled engineer to take charge of it, and the next most common thing is to give him as little pay as possible. It is very common, on land, to have this skilled engineer take charge of the engine and boiler, and do other work around the establishment in which he is employed. Should an accident happen to the engine or boiler while he is employed in another part of the establishment, he must shoulder the blame, because he was hired to take charge of the engine. I have heard some say: "I would not do anything but look after the engine and boilers if I were working for such a firm." That would be "labor against capital." An engineer must either do what capital dictates or get out, and this getting out business seldom fills the hungry mouths at home. I think owners of

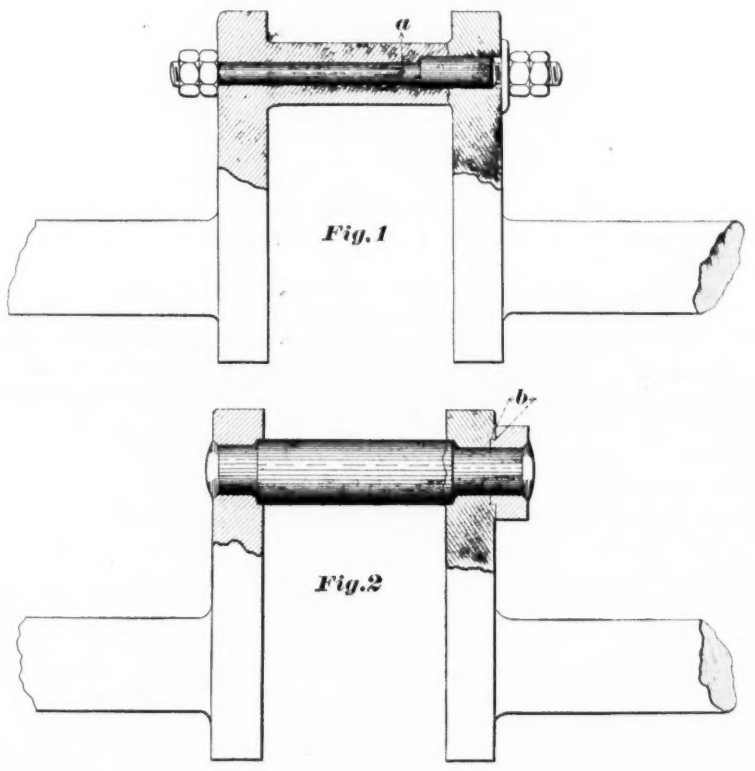


Fig. 1

Fig. 2

boilers should be held responsible more than they are.

To illustrate by a true case. Mr. B. owns a set of boilers that have been in constant use since 1845 (thirty-eight years). Part of the time these boilers are run night and day. In course of time the engineer reports the boilers as being in very bad condition, and recommends the getting of new ones. A boiler-maker is consulted, who gives it as his opinion that the boilers can be repaired, and when done will be better than new boilers, and will not cost nearly as much. The boilers are repaired, and the engineer learns—1st, that his opinion amounts to nothing; 2d, that a patched boiler thirty-eight years old is better than a new one. Who should shoulder the blame in case of an accident to those boilers? We all know that the engineer, from custom, would have to bear his share. An engineer who understands his business is always on the look-out for defects in his engine and boiler, and knows the condition of his boiler better than all the inspectors in the country, for the simple reason that he handles that boiler every day, and knows, as it were, every rivet in it. If he properly attends to his business, he finds out every month, or oftener, what the inspector tells him once or twice a year. Such a man is the one to be trusted, and his opinion in regard to what is necessary should have weight. Were his opinion acted upon, in many cases the weight would be moved toward the valve instead of to the outer end of the lever. But I have known the weight to go to the end of the lever and a monkey-wrench to be placed alongside it, because the firm insisted that they must have more steam and that there was no danger. Who would you blame for an accident in such a case?

I remember a case where an engineer reported his boiler unsafe, a large crack having been discovered on the bottom. The boiler was carrying 80 lbs. steam, and the firm were anxious to run a few weeks longer before doing anything to the boiler. The engineer agreed to carry 40 lbs. of steam, which was all he considered it safe to carry. This led to a dispute, which was only settled when the inspector decided that the engineer was right, and the carrying of any more pressure would necessitate the closing of the place. When a new boiler was put in about four weeks later, the old one (two years old), four-feet shell, was found to be cracked for a distance of six feet around the shell.

A practical knowledge of a boiler is as good sometimes as an extra row of rivets, and a theoretical book knowledge of a boiler is not a safe rule to work by, especially when you get in a corner.

I think it would be well to have an inspector to inspect the owners of boilers as to what chances they are taking with them, so far as using their judgment as to how they shall be run. Then we want an inspector for engineers—one that will not make out a license until the applicant has really proved himself to be a competent man to take charge of boilers. Let us have some kind of a change, so that the engineer, in case of an accident (should he escape with his life), will not be pounced upon and set upon by a jury, who will surely condemn him, because that is the custom.

Engineer.

How a Broken Crank-Shaft Refused to Stay Mended.

Editor American Machinist:

If correspondents had the nerve to report their failures as well as successes in some of their experimental operations, the craft would be equally if not more benefited thereby.

The instances are rare where the same conditions exist in different cases, and an intelligent mechanic can oftener better judge of the feasibility of a proposed or contemplated plan by a knowledge of the failure of some other seemingly practical expedient, which has cost the experimenter many dollars and much disappointment. But it is not likely that human nature will ever be unselfish enough to expose its failures, from motives of pure philanthropy.

Confessing to the weakness, I nevertheless purpose to tell how I did and didn't mend a broken shaft, of which I am reminded by its similarity to the one described in your issue of September 22d. A steel shaft, with a 12″ throw crank, and a crank-pin 12″ long by 4″ diameter, was brought to the shop broken at exactly the same point as the one alluded to by your correspondent. The shape of the fracture was such that it was thought, if the surfaces could be held together, it would do its work. An examination of the engine disclosed the fact that the pillow blocks were slightly out of alignment, and that the crank was driven by a short horizontal-forked connecting rod, which straddled an equally short vertical rod doing heavy intermittent duty.

It was advised to line up the engine throughout, and make a new shaft, but the customer could not wait for this, and as a part of the engine was running continuously, it was impossible to put the blocks accurately in line. The shaft was consequently held in correct position, and a 1½″ hole bored lengthwise through the center of the pin, and enlarged to 2″ through the point of fracture, as shown in Fig. 1. A wrought-iron bolt was then fitted to the hole and the parts held together by nuts on each end of the bolt.

This served the purpose for three days, when it was found that the bolt had pulled apart at the point marked *a*, although the shaft was still running—owing to the shape of the broken surfaces of the pin. The shaft was again taken out and the pin planed off even with the cranks, the holes in the cranks enlarged to 3″ and a 4″ counterbore let into their inner surfaces ¼″ deep, and also on the outside surface of the crank nearest the fly-wheel; shown at *b*, Fig. 2.

A new Bessemer steel pin was made (this pin was to have been wrought iron, but by a mistake of the blacksmith steel was used, and had too far advanced to throw away when discovered, as it was a "hurry job") with the ends turned down to 3″ and one crank shrunk on, the end of pin extending through 2″. A wrought-iron ring 6″ diameter by 2″ thick, with one face turned to fit into counterbored recess, was then forced on to the projecting end of the pin and the pin headed over. This was done to support the pin in a longer surface-bearing than the crank afforded, which was only 3″ thick over all.

The other crank was then shrunk on to the other end of the pin, and pin headed over.

The whole shaft and pin, thus mended, was found to be in perfect line.

It ran about three days, and broke off at exactly the same point where the original pin broke, *i. e.*, through the main body.

Further comment is needless, except to say that it is thought if the pin had been of wrought iron it would have lasted about three days longer.

The only cure was a radical one, as at first advised. The bearings were set in line and a new shaft made, which is running all right.

E.

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NEW YORK, OCTOBER 6, 1883.

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With this issue the American Machinist appears in a dress of new type, but without making any departure in the style of its make-up. Clear type and good print are what our readers expect, and although the type formerly used was not badly worn, a new dress (after the old pattern) makes an improvement.

Many months ago, when the price of printing paper declined, we secured a better quality. Now that it has again slightly declined, we have begun using paper about seven per cent. heavier. This will enable large cuts to be printed with somewhat better effect.

We regard typographical progress, however, as second to the more important consideration of progress in seizing upon and recording the mechanical improvements of the times. To this end, as heretofore, we shall direct our best energies, and it is pleasant to know that our readers are not slow to appreciate the fact.

Credit for Inventions.

A communication, which we publish elsewhere, having reference to a leveling instrument shown in our issue of September 1, is suggestive of some thought as to whom the credit is really due for almost any mechanical device that may be brought out. We are aware and supposed our readers generally were (the fact having been published some years since) that a rubber hose with a glass tube inserted in each end had been used for finding levels around obstructions and through considerable distances, but did not know, or had forgotten, to whom the credit of first making its use public was due. Nor did we suppose it material, since the practice of finding levels by the water or spirit level is too old to be traced to its origin, and the use of the rubber hose to hold the liquid and extend the distance as well as to shun obstructions is merely an ingenious adaptation of the general principle. Our correspondent may have been the first to use the rubber hose for the purpose of finding levels, and it is pleasant to be able to record his claim to something so ingenious. Presumably the manufacturer of the device to which he refers was the first to make an instrument or tool of it for general use, by adding what he believed to be important parts, and by putting it into portable and convenient shape.

Entirely aside, however, from any question as to the credit for or the utility of this particular instrument, there is, generally speaking, but little "new under the sun," the great majority of inventions—if they ought to be called inventions—being presumed improvements on some other plan of accomplishing the same end. Cutting off steam in the cylinder of a steam-engine with a slide-valve, for instance, is old, and the valve is the most important factor used, but new and (some of them) valuable ways of accomplishing the end are constantly brought forward, and usually along with one novel feature several common ones are used. But because there is little new in a valve-gear—or other mechanical device—it by no means follows that it is not valuable, or that the one who adds that little is not deserving of credit. Even if he adds nothing except brains enough to make something operate satisfactorily that would not do so before, he gives it all the value it possesses.

A great deal is said in one way and another about reinventing ancient devices, but if by this means anything hitherto useless is made useful it ought to be satisfactory. It is difficult to see, as is generally inferred, that some one has been defrauded in the operation. The value of any mechanical appliance is in what it accomplishes, not in the combination of parts or pieces, and the man who makes it work, by additions or amendments, is the one who benefits the public. Too much solicitude for those who buy and use such appliances is apparent. They judge by results, and are not likely to be defrauded to any extent. If the device, whatever it may be, possesses no value it isn't likely to sell, and the one most injured is the one who tries to sell it. If it is of value, the fact of its being old or new does not change its value.

It is undoubtedly true that no one is likely to be at especial pains to divide the credit for some useful invention, or to go back in the effort to find where the credit really belongs. There may sometimes be injustice in this, but in these matters as in most others success is all that counts, because it is all that gives value.

Some Causes of a Railroad Accident.

After the recent accident at Hunter's Point, on the Long Island Railroad, where a train running with the vacuum brake disabled smashed into a train just moving out of the station mentioned, General Barton, the superintendent of the road, made several decided statements putting the entire blame of the accident upon the engineer. The evidence elicited at the coroner's inquest changes the aspect of the case considerably. From the facts stated by the various witnesses, we are disposed to think that if one man ought to be saddled with the blame of the accident, that man is General Barton.

It appears to be the custom on that road to run cars with so much diversity in the height of drawbars that the ordinary coupling cannot be used, and a loose link has to be resorted to, while the brake hose needs a supplementary piece in order to make connection. On the day of the accident this piece of hose gave out, on the car next the engine, and in consequence the train had to be rnn depending on hand brakes. For some distance before reaching Hunter's Point, the train traversed a descending grade, and at the top of this descent the engineer asserts that he shut off steam, and other evidence was given to prove that he commenced whistling for brakes half a mile before reaching the station. When he found the speed was not being reduced, he reversed the engine, but not in time to avoid running into another train, killing three persons and severely injuring a great many more.

Accidents of this character are the natural result of moving trains without proper braking facilities. Running any passenger train without continuous brakes is subjecting travelers to serious and unnecessary risk; running passenger trains in such a condition, on a crowded line like the Long Island Railroad, is an act of criminal recklessness. It is well known among railroad men that the use of continuous brakes prevents conductors and brakemen from gaining experience about the controlling of trains with hand brakes, the consequence being that these parties cannot longer be trusted to brake a train safely.

Probably, in this case, they did not know that the train was descending the grade at a dangerous speed; and there seems to have been more attention devoted to the collecting of tickets than to guarding against an accident.

The conspicuous mistake made about the train was in not switching the car with the disabled hose to the end of the train. Here the management was at fault, in not providing for such an emergency. The conductor alleged that it would have taken him an hour to do the switching. If that was the case, it must take about twelve times longer to do work of that kind on the Long Island Railroad than it does on other roads.

The shock of the accident was badly aggravated by the defective method of coupling the cars. One feature about the Miller platform, that has done so much to reduce the fatality of railroad accidents, is the close-connecting drawbar, which makes the line of concussion continuous. Mixing cars in a train, with drawbars of different height, is an invitation to fatal disaster, when even a slight collision occurs. This was the real secret of the fatality of the Hunter's Point accident, for the collision was not violent enough to smash the cars had they been properly coupled.

A correspondent writes requesting information from some of the readers of the American Machinist as to the best plan of discharging shavings by a fan from wood planing machines, particularly as to the construction of the receptacle to prevent the escape of dust. Another correspondent would like to hear from some one who has had experience in the matter as to how he can construct a small safety boiler of about 1½-horse power. He would like to made a quick-steaming safe boiler to carry 50 lbs. steam. Would like to avoid brick-work, as his space is limited. He has a quantity of 1¼" steam-pipe which he would like to utilize if practicable.

We clip the following item from the second issue of the *Dallas Machine Journal*, of Dallas, Texas:

"A few brief lines in the Americam Machinist of a late date, noticing the first issue of the *Machine Journal*, forcibly illustrates the care with which that excellent paper is read by its many patrons. Already we have received a score or more of letters from manufacurers referring to the above notice, and quite a number from artizans, draughtsmen, machinists and boiler-makers, referring to aforesaid notice, and making inquiries about the inducements offered in Texas in their several lines; while in the way of circulars, cards and pamphlets, we could load a cart with recent receipts, and have sufficient left for ordinary business purposes."

Compound Locomotives.

The Webb Compound Locomotive, which is illustrated and described in another column, represents a form of engine which is attracting great attention in Europe. In this design of engine two important improvements are effected which give a striking individuality to the locomotive. By means of the low-pressure cylinder the steam has been expanded down to a point that approaches the best forms of stationary engine practice, and by connecting the low-pressure piston to the forward drivers and the high-pressure pistons to the back drivers ample adhesion is secured, while the side rods are dispensed with. Considering the radical changes made and the desirable results obtained, the engine is a model of simplicity and ingenuity.

Several new arrangements in the details of this locomotive are worthy of consideration from our own locomotive designers, as they could be applied to American engines without much difficulty. Webb's plan of carrying the water space of the fire-box under the grates, although nothing new, strikes us as an easy way of overcoming the annoyance of leaky mud rings, and it will certainly improve the water circulation. His method of putting the steam-chests under the cylinders with the valves below, so that they will fall from the seat when the engine is running without steam, might be used to advantage on our roads with long grades, although the inconvenience in effecting repairs might overbalance the saving of wear effected. While we hardly regard this as the type of the future high-speed economical American locomotive, we would like to see one of them coupled to a heavy express train on one of our leading roads; and we believe it would pay a railroad company to try the experiment.

Engineers and Boiler Inspectors.

Many engineers are averse to having their boilers regularly examined by outside inspectors, connected either with a boiler-insurance company or with the municipal government. It is easy to understand why careless or incompetent engineers oppose inspection by anybody not subject to their control, but it is a mistake for efficient and trustworthy engineers to manifest hostility towards any good system of inspecting boilers. Engineers frequently recommend changes in boilers, or repairs that are needed, without avail. The proprietors are either too careless or too penurious to make the changes, or they have become accustomed to disregard the advice of the engineer, as hardly worth listening to. Such a situation of affairs is very unpleasant to a self-respecting engineer, and he often refrains from offering proper suggestions about changes rather than submit to be snubbed by his employer. The inspector of the insurance company, or the official city inspector can have needed changes made without special urging. Their recommendation carries au-

thority with it. Why should any good engineer refuse to recognize the assistance of a good inspector to secure what he knows is needed upon the boilers which he has in charge? Of course an efficient engineer will know the condition of his boiler by personal examination, and where his advice is followed by the proprietor, in regard to changes, the best interests of both parties will be conserved. Wherever the owner of a steam boiler has an engineer employed whose advice is not worth acting upon, the best course for him to pursue is to discharge that man and hire one whose professional advice is entitled to some consideration.

If "Langtoon," Philadelphia, will send us his name and address, we will notice his communication.

Progress in Trade Catalogues.

There has been as much improvement in the general character of catalogues of machinery tools and mechanical appliances within the last half dozen years as in the character of the articles they represent upon their printed pages. As the average of mechanical productions grows better so does the average of trade catalogues. Not only do the latter show what devices and designs have been originated to better accomplish machine-shop work, but they also show how these improvements may be represented in a more intelligible and more attractive manner than they formerly were. Still there is abundant room for further progress in the preparation of catalogues, the variation in quality from the best to the poorest being greater than that from the torrid heat of midsummer to the frigid temperature of midwinter. The worst feature in the poorer catalogues is the execrable appearance of the engravings. Upon what clearly defined business principle the manufacturer of a well-designed and well-constructed machine proceeds when he has a ratty distorted engraving made to represent it upon paper, we are at a loss to determine. It cannot certainly be because of the saving of money over the cost of an engraving having a respectable appearance. It would be far cheaper to give the cost of the poor engraving to the first hungry or thirsty tramp that comes along and have no cut made than to send to several thousand prospective customers a smudgy caricature of the machine they are supposed to desire information about. Good engravings can no more be had at a very low cost than good machinery. They are expensive, but not a quarter as expensive in the long run as poor ones. There is no cheap process by which cuts in shaded perspective can be made just as good as wood engravings at lower prices. The best outline or skeleton cuts are made by the wax process. Many catalogues are spoiled by poor printing, for which about as much is paid as for good printing. It only requires fair discrimination to secure the best grade of typographical work.

Machinery catalogues are intended to be descriptive of the objects shown by cuts, but the percentage of deficiency in this respect is remarkable. Where we find one catalogue that conveys intelligible ideas of the peculiar devices and appliances embodied in the objects represented, half a dozen leave the most essential portion to be studied out or guessed at by the parties into whose hands the publications fall. As an aid to a correct understanding of machinery, outline cuts of details are often desirable. These may be made to occupy but little space. Much valuable technical information is given in some catalogues aside from a description of the articles manufactured by the publishers of the same. While this feature is a good one it is not essential, as an otherwise well-prepared catalogue has enough interest to lead to its preservation for reference.

During a recent strike of glass workers at Pittsburgh several indentured apprentices went out with the men. They were arrested, and the court required them to return to their work.

Questions and Answers.

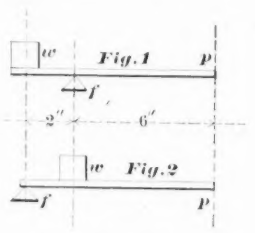
Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(316) S. H., Boston, Mass., writes: I want to run a steel shaft 3″ diameter with an end pressure of 4,000 lbs. How large should the step be? *A.*—There is the widest diversity of practice in respect to the dimensions of steps for shafts. We think if the pressure is continuous it should not be more than 100 lbs. per square inch, and it would be better if considerably less than that: say not more than 50 lbs.

(317) A. R., Harrison, Me., writes: I want to know how to temper coiled springs, and if such springs can be made of any other than cast steel? *A.*—Such springs are usually hardened in oil and tempered by blazing off. Different brands of steel require slightly different treatment, and skill in tempering is only to be acquired by practice. Any reputable American manufacturer of steel will supply you with a brand adapted for making springs.

(318) Inquisitive, Whitinsville, Mass., writes: 1. In your issue of June 7, "Mental" writes of cutting 1¼ threads to the inch with a 60 and a 20 wheel. I would like to know how many revolutions the spindle made to one of the lead screw; also the pitch of the lead screw? *A.*—If the gearing was direct the lead screw would be—20 : 60 : : 1¼ : 3¾ threads per inch, and the revolutions of the spindle and screw, as 3 to 1. There may have been modifications in the gearing in the way of a feed spindle. 2. Please let me know if in cutting gears the rule is to allow two parts of the pitch for the depth of tooth. For example, a gear of 30 teeth, 10 pitch, would be 3″ pitch diameter and 3 2-10 inches outside diameter; would the depth of tooth from outside of wheel be 2-10 inch? *A.*—The depth would be a little more than 2-10 inch, to allow for clearance. With the Brown & Sharpe cutters the depth would be .216 inch.

(319) R. H., Rochester, N. Y., sends the accompanying sketch and asks: Will the same force on each lever move equal weights? *A.*—In



the sketch *w* is the weight, *f* the fulcrum, and *p* the point at which force is applied. With the lever used as in Fig. 2, but ¾ the force will be required to move the weight that will be required when used as in Fig. 1, because, while the distance *w* to *f* is the same in both cases, the distance *p* to *f* is 8″ in one instance and 6″ in the other.

Business Specials

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Match Machinery, F. Chillingworth, New Haven, Ct.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

See *our* list of *cheap machinery* on page 15. Logan Machine Works.

Small yacht engine castings. Send stamp for circular. J. L. Lucas, Middleboro, Mass.

The latest Improved Match Machinery is made by the White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh Wells, & Co., corner Fulton and Dutch streets, New York.

Universal grinders for lathe-centers, chucks, angles or cylinders. C. C. Hill, 144 LaSalle st., Chicago, Ill

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 58,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Bound Volumes of the American Machinist for 1880, 1881, and 1882. A limited number of each sent by express for $4 per volume, express charges to be paid by purchaser. Amer. Machinist Publishing Co., 96 Fulton st., New York.

"HOW TO KEEP BOILERS CLEAN."—A book of seventy-two pages, telling how to prevent scaling, foaming, priming, and burning, with other valuable information, will be sent to any address FREE of postage, by James F. Hotchkiss, 86 John street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. American Machinist Publishing Company, 96 Fulton street, New York.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

Slide valve working models, $2 each. Full size working drawings for making same, 25 cents. Shows effect of lap, lead, expansion, cushion, &c., at a glance. Will forward on receipt of money or stamps. Also "Useful Hints on Steam," 96 page book, mailed for 15 cents. E. E. Roberts, manufacturer of engines and boilers, 107 Liberty street, New York.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the American Machinist; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Credits.—Ealy's "Blue Book," July, 1883, just published, contains a complete classified list of over 100,000 names of machinists and dealers in machinery, railway machinists, engine and boiler makers' supplies, brass goods, metal, etc., in United States and Canada. The book is condensed making it much more convenient to handle than a larger agency book. It gives the financial standing and paying qualities of all dealers and manufacturers in the above-mentioned lines of trade. For terms, etc., address The John W. Ealy Company, 51 Chambers street, New York, or 79 Dearborn st., Chicago, Ill.

Manufactures.

The Aurora (Ill.) Watch Company are to erect a $35,000 building for a factory.

The contract has been given out to erect the Henderson (Ky.) Cotton Mills for $75,000.

J. R. Bodley, 18th street, Wheeling, West Va., has obtained a building permit to erect a factory of brick.

Work has begun upon the foundation of the new Boston & Lowell Railroad machine shop in Lowell, Mass.

Leo Schleisinger, 11th street and Avenue D, New York, will erect a seven story factory and store on Crosby street, to cost $110,000.

Lyndonville, Vt., expects a Maine firm will establish a foundry and machine shop in the village, with some thirty additional families.

Sutton & Barnes, Oshkosh, Wis., are making the machinery for the match factory that is to be started up at their place in a short time.

Russell & Chapin are erecting a building for a match factory, at Manistee, Mich., 30x50 feet. Other buildings connected with the factory will be erected.

The Rome (Ga.) Cotton Factory has increased its capital stock 50 per cent. for the purpose of enlarging the building and doubling the capacity of factory.

The Weindel & Wirthlin Manufacturing Company, of St. Louis, are to erect a new barrel factory. The building is to be of brick, and two stories high.

Grant & Bogert, Flushing, N. Y., have shipped to Thomas Shanks & Sons, Johnstone, Scotland an 18″ friction countershaft, selected by Mr. Wm. Shanks on his visit to this country a few months ago.

The Lagonda Agricultural Works, Springfield, Ohio, have ordered a Blakeney Cupola Furnace of 30 to 35 tons capacity, after using a furnace of the same patent of 15 tons for the past seven years.

Holland & Thompson, Troy, N. Y., has issued a pamphlet entitled "Hints on House Warming and Ventilation," in which a new boiler of their manufacture for steam-heating purposes is described.

The stockholders of the Griffin, Ga., Manufacturing Company have called in 15 per cent. of the $70,000 subscribed for a cotton factory. It is proposed to put 4,000 spindles and 126 looms into the mill.

The Newago Furniture Company has been fully organized at Newago, Mich., and a factory is in process of construction. Water power will be employed. One hundred hands will be needed at the start.

The Brown & Adams Manufacturing Company of St. Louis, Mo., will soon increase its capital stock and greatly enlarge the capacity of its works by the erection of new buildings and the putting in of new plants of machinery.

The National Manufacturing Co., New Haven Conn., manufacturers of the National Chuck, were recently burned out. They have taken the shop formerly occupied by D. Frisbie & Co., and are ready to supply the demand as heretofore.

The wages of the employes of the Saco Water Power Machine Shop, Biddeford, Me., have been reduced ten per cent. About 500 persons are employed. Fortunately very few machine shop owners reduce wages on the wholesale plan.

A. W. Danforth, formerly engaged in the manufacture of cotton goods at Newburyport, Mass., will be the director of the new cotton mill started at Shanghai, China. There will be 400 looms and 20,000 spindles, the machinery being part American and part English.

Anderson Bros., Peekskill, N. Y., are about ready to move into their new machine shop, 26x60 feet of brick, three stories high. The boiler room, office and drawing room, are in a wing to main building. They are making experimental machinery and telegraphers' supplies.

The rail mills at South Chicago, owned by the North Chicago Rolling Mill Company, have, after a long strike, agreed with their workmen upon a basis for resuming operations. The agreement is to last the remainder of the year. Two thousand men are employed in the works.

The Gage Machine Works, Waterford, N. Y., have made arrangements to manufacture the Brook's Patent Shawl Fringe Twisting machines; also make extra parts and repairs for machines now in use, and are the sole manufacturers of these machines. They have lately shipped two machines to the Waukesha Woolen Mills, Waukesha, Wis.

Building permits have been issued in Philadelphia to James Lansing, contractor, for the erection of a foundry 69x96 feet at Passymunk avenue and Federal street; W. Massey, contractor, for the erection of a four story factory, 18x60 feet, at 618 Filbert street; J. B. Doyle, contractor, for the erection of a three story factory, 80x118 feet at 29th and Brown streets.

Charles E. Lipe, of Syracuse, N. Y., writes us from the Cincinnati Exposition: "I have my Universal Milling Machine in practical operation here now. It is attracting considerable attention among tool men on account of its original design, strong construction and novel treatment of details. Am very much interested in Mr. Grant's articles. I am one of those who believe that the milling machine as a factor in machine production is in its infancy."

The Babcock & Wilcox Company, 30 Cortlandt street, New York, have shipped boilers to the extent of 10,000 H. P. in the last month. They have 1,000 H. P. boilers now in course of erection at the Havemeyer Sugar Refinery Company's house at Greenpoint, being the fifth order from that company. They have also just received an order from the Portage Straw Board Company, Akron, O., for 1,474 H. P. of boilers, being the tenth order; and New York Steam Company, New York City, have ordered 2,750 H. P. in addition to 5,000 H. P. already in. A small boiler of 120 H. P. has been contracted for by Walter A. Wood, Mowing and Reaping Machine Company, being this firm's second order.

The Brown & Sharpe Manufacturing Company of Providence, R. I., as most of our readers know, have for several years published a small pocket catalogue of their machinery and tools. Now, they have issued an additional catalogue with printed pages 9x6 inches, exhibiting large engravings of their milling machines, universal grinding machines, surface grinding machines, tool grinder, gear cutting machines, engine lathe, screw machines, tapping machines, hand lathes, gauges, surface plates, work bench, micrometer calipers, gear cutters, milling cutters and other tools and specialties. The descriptions are brief and to the point, the engravings clean and perspicuous and the typographical execution without fault.

The Nicholson File Company, Providence, R. I. have issued the following circular:

"After several years of most earnest labor it is with no little degree of satisfaction and pride, that we announce our ability to furnish, of our own production, the *very fine* class of small files, used by jewelers, watchmakers, silversmiths, fine tool makers and others.

"Our aim is that these files, in quality of steel, beauty of shapes and varied degrees of fineness of cut, shall be unsurpassed by *any* of the Swiss or Warrington makes of this class of goods, which have for so long a time held the American market to the exclusion of all domestic makes.

"To distinguish these from our regular goods, we have chosen the letters [X-F] as our symbol or trade mark, which will be found upon all original packages of our make.

"To be able to provide ourselves with a stock of all the kinds and cuts, for which a demand may possibly exist, will require some little time and experience on our part. But as fast as the demand for any kind which we do not now offer to the *trade*, comes to our knowledge, it will be our aim to provide a stock of the goods.

"At the present time we are prepared to receive orders for the kinds and cuts of files named on our [X-F] *list* of this date, many of which we can promptly ship from our present stock on hand."

Machinists' Supplies and Iron.

New York, September 20, 1883.

There is no change in the supply business from that of a simply fair condition. Apparently those who expect either a rush or a state of depression are to be disappointed. Buyers are ordering in small quantities, and expect prompt delivery, and dealers are not disposed to carry heavy stock.

The Brown & Sharpe Mfg. Co., Providence, R. I., have issued a large illustrated catalogue in which the machines manufactured by them are displayed by some very fine engravings, and tersely described.

In American Pig Iron the transactions are limited, with no disposition of consumers to buy beyond immediate wants. Furnacemen are not pressing their products, so that although they are in excess of demand, prices remain substantially stationary. We quote standard brands of No. 1, X Foundry at $22 to $23, with sales mostly at former price. No. 2 X, Foundry, $20 to $20 50. Grey Forge is sold at furnace for $18, but inferior brands are obtainable at $17 to $17.50.

In Scotch Pig there is but little doing. We quote at yard, Coltness, $23.50; Glengarnock, $23.50; Gartsherrie, $23.50; Summerlee, $22.50; Eglinton, $20.50 to $21. Prices to arrive are generally $0.50 lower.

Antimony is in light demand, with Hallett's brand 9c. to 9¼c., Cookson's 10¼c. to 10¼c.

Copper is firmer, with Lake at 15¼c. to 15½c., other brands 14¼c. 14½c.

Lead is steady at 4.3¾c.

Spelter 8c. to 8¼c. for refined, Silesian 5c. to 5¼c.

Tin shows a slight improvement. Jobbing lots of Banca have sold at 21¾c., Straits and Malacca, 21¼c. to 21¾c.

In Boiler Plate the market is not strong nor orders plenty. We quote prices as follows;

Tank, 2½c. to 2¾c.; Refined, 2¾c. to 2 9-10c.; Shell, 3¼c. to 3¾c.; Flange, 4¼c. to 4¾c.; extra Flange and Fire Box, 5¼c. to 5½c.; Siemens Steel Plate, 5½c. to 6c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—Position as foundry foreman; practical abilities guaranteed. Address Box 9, Am. Machinist.

Young man wants to learn the machinist trade. Address, W. I. Brock, Nantucket, Mass.

Wanted—Situation as superintendent by one that is well posted in steam engineering. Address, Box 4, care American Machinist.

A mechanical draughtsman, of good technical education and experience, desires a situation. Address "Draughtsman," P. O. D 38, New Haven, Ct.

Chemist disengaged; iron, steel, phosphate, &c. Sugar a specialty. Good references. Will take foreign position. "Chemist," care Am. Machinist.

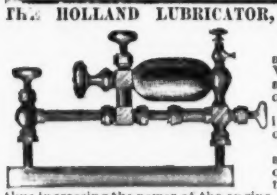
Wanted—Competent mechanical draughtsman; one having experience in printing machinery preferred. Address, stating qualifications, age, &c., Abingdon, at office of this paper.

A reliable and competent mechanic desires a situation as superintendent or foreman. Experienced in management of shop and men, designing and constructing tools, fixtures, etc., for the economical manufacture of duplicate or interchangeable work. Good references. Address, box 2, American Machinist.

Manufacturing property for sale, 30,000 feet floor space, competing point for four trunk lines railroads, switch from door. Write for terms and description B. W. Payne & Sons, Corning, N. Y.

Wanted—One or more partners, with small capital, in a manufacturing business; sure cash sales and large profits. Address Arthur Steuart, 58 N. Charles street, Baltimore, Md

UPRIGHT DRILL PRESS $75.00
KEY SEATING MACHINE $55.00
SEND FOR CATALOGUE TO
W. P. DAVIS
NORTH BLOOMFIELD, ONT. CO. N.Y.



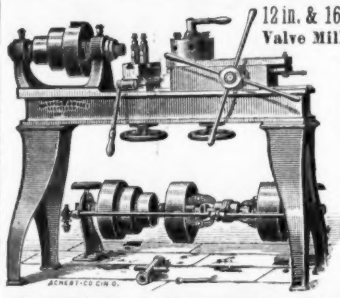
THE HOLLAND LUBRICATOR, VISIBLE DROP,

Is guaranteed to be
1. A perfect insurance against the cutting of Valve-seats, Cylinder and Governor Valves of the engine.
2 It will pay for itself in 6 months in saving of oil, coal, and packing.
3 It will insure more speed in the revolutions of the engine, say from 1 to 2 strokes per minute, thus increasing the power of the engine. Manufactured by
HOLLAND & THOMPSON, 217 River St., Troy, N Y

STEWART'S READY ROOFING

For STEEP and FLAT ROOFS of all kinds; can be applied by ordinary workmen at ONE THIRD the cost of TIN. Send for a sample and our circular which gives full directions how to apply your own roof; also how to repair leaky roofs of all kinds. Address,
W. H. STEWART,
74 Cortlandt St., New York.

BRASS WORKING MACHINERY.

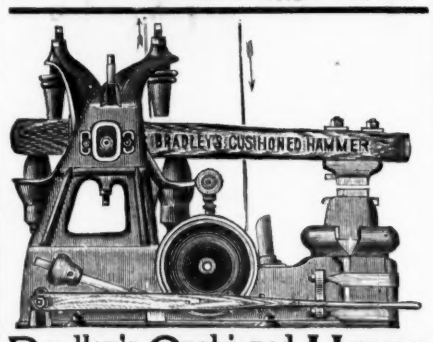


12 in. & 16 in. Monitors
Valve Milling Mach's
Double Key Lathes,
Speed Lathes
Slide Rests
Revolving Chucks for Globe Valves,
Two-Jaw Chucks,
Small Tools and Fixtures.
WARNER & SWASEY, Cleveland, O.

COOKE & CO., DEALER IN

Machinery & Supplies,
22 CORTLANDT ST.,
NEW YORK.
AGENTS FOR THE
Greenfield Vertical Engines
2½ to 30 Horse Power.
Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.
ALSO
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

FORBES & CURTIS,
Bridgeport, Conn.
M'f'r's of
FORBES' PATENT
Die Stocks,
For threading and cutting off pipe without the aid of vise. Only one man required to thread 6 in. pipe

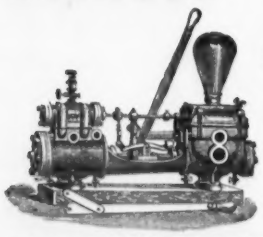


Bradley's Cushioned Hammer
Stands to-day WITHOUT AN EQUAL.
OVER 800 IN USE.
BRADLEY & CO., Syracuse, N. Y.
ESTABLISHED IN 1832.

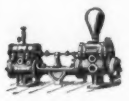
If You Want the Best STEAM PUMP
For Mining, Railroad or Steamboat use, Paper Mill, Chemical or Gas Works Tannery, Brewery or Sugar Refinery Draining Quarries, Cellars or Plantations, Irrigating or Hydraulic Mining, Sinking Foundations, Coffer Dam, Sewer, Well Sinking and other Contractors' Work, or Raising Water for any kind of Manufacturing or Fire Purpose, write for an illustrated descriptive book on the New Pulsometer, containing greatly reduced prices, hundreds of testimonials, etc. Mailed free. Prices 100 per cent lower than other. Every pump tested before shipment and guaranteed as represented. Economy and Efficiency Unequalled. Pulsometer Steam Pump Co., 83 John St., N.Y. See prices next issue of this paper

"COMPOUND" BOILER;
HOW TO USE IT AND RUN IT AT SEA.
Explaining causes of all corrosion and the formation of scale, with instructions for its entire prevention, together with useful information for maintaining Steam at Sea. Illustrated. By a Sea-going Engineer. 8vo, paper, 40 cents.
E. & F. N. SPON, 35 Murray St., N. Y.

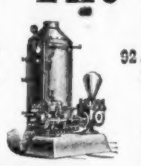
KNOWLES PATENT STEAM PUMPS.
THE STANDARD!



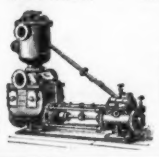
THE BEST MADE PUMP! THE BEST PUMP MADE!
Estimates furnished on application for Pumping Machinery of any capacity, and to work against any pressure.
Air Pumps and Condensers for Steam Engines a specialty. Will save from 20 to 30 per cent. fuel.
SEND FOR ILLUSTRATED CATALOGUE.
Address KNOWLES STEAM PUMP WORKS
93 Liberty St., New York, and 44 Washington St., Boston, Mass.



The Deane Steam Pump Co.
HOLYOKE, MASS.
Send for new Illustrated Catalogue.



92 & 94 Liberty St. NEW YORK. | 54 Oliver St. BOSTON. | 49 N. 7th St. PHILA. | 226 & 228 Lake St. CHICAGO. | 620 & 612 N. Main St ST. LOUIS.
INDEPENDENT CONDENSING APPARATUS A SPECIALTY.



MANUFACTURE
STEAM PUMPING MACHINERY
For Every Possible Duty.

UNION STONE COMPANY,
Patentees and Manufacturers
OF THE
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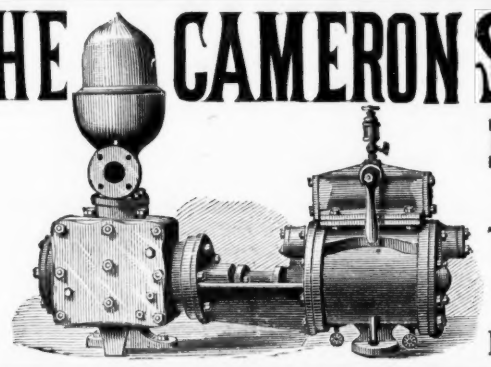

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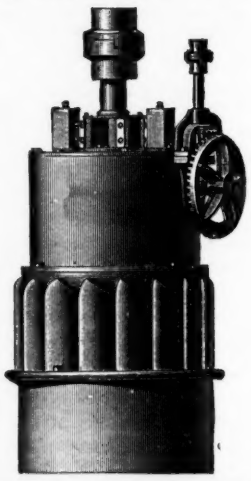

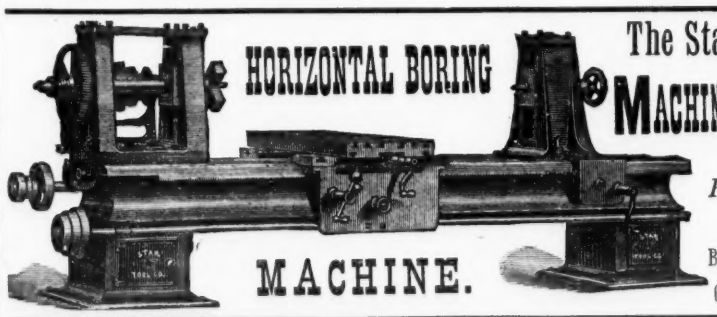

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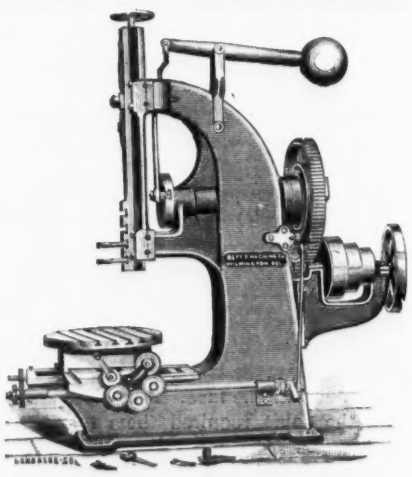

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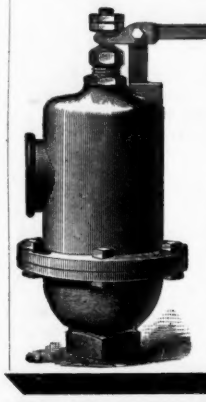

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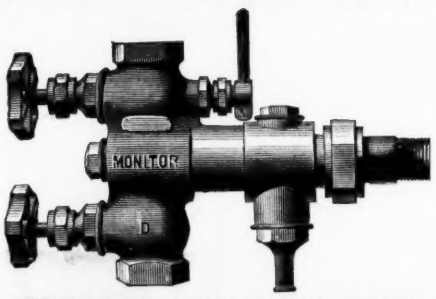

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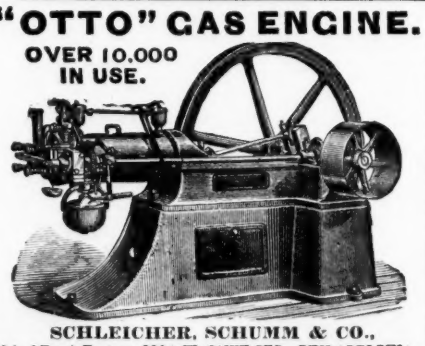

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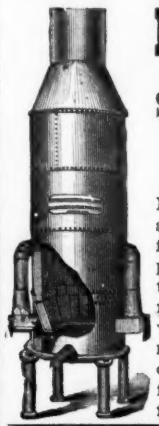

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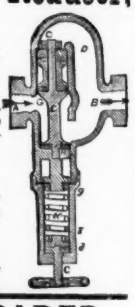

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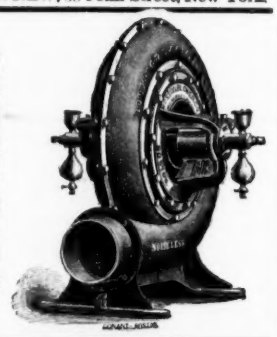

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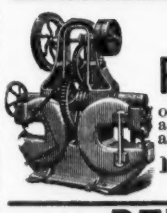

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" 11	1 3-4 "		1.25
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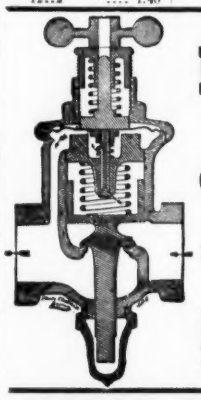

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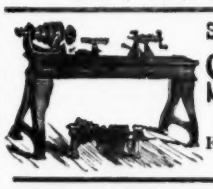

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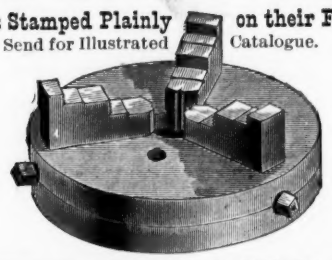

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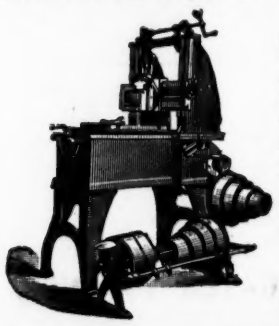

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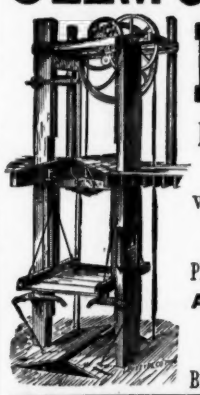

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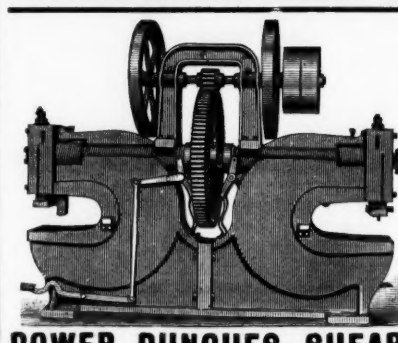

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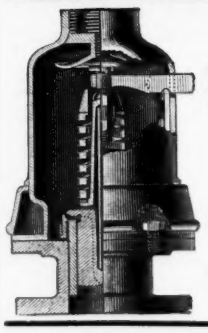

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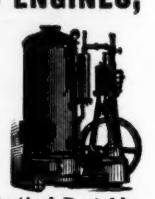

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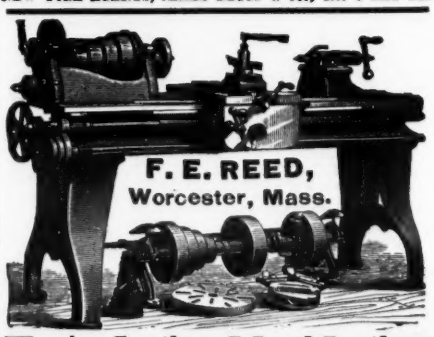

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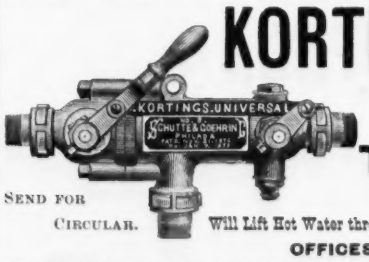

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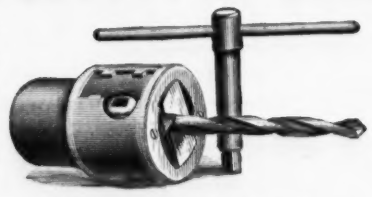

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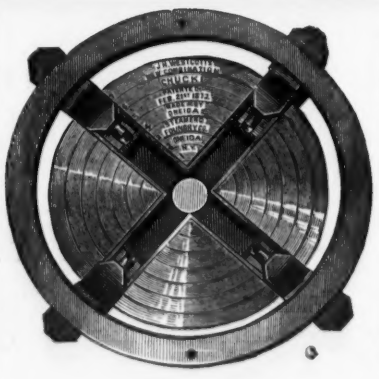

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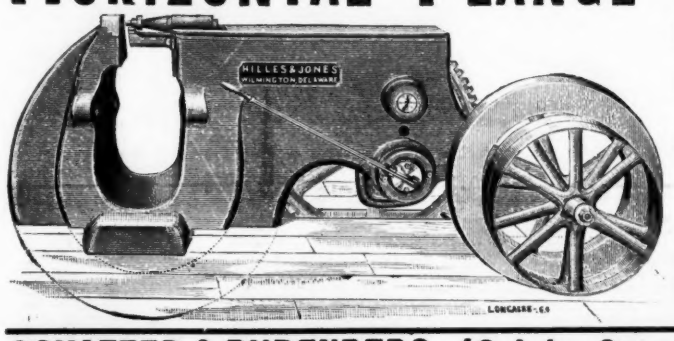

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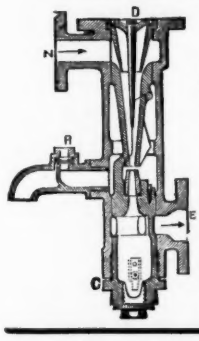

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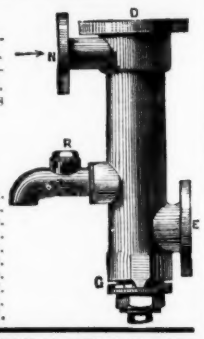

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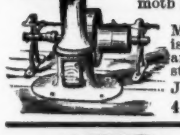

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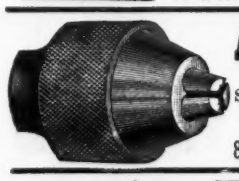

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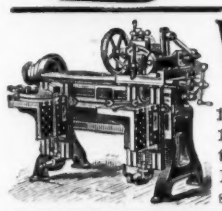

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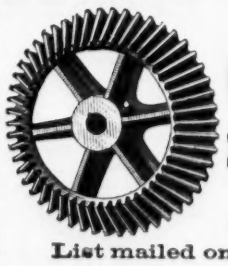

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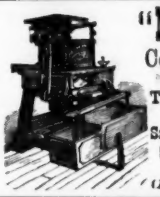

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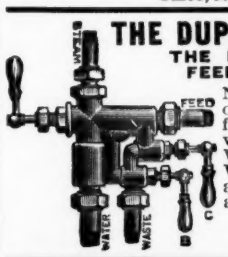

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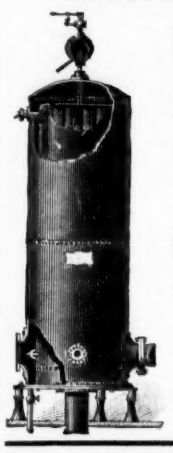

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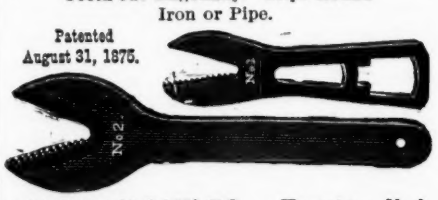

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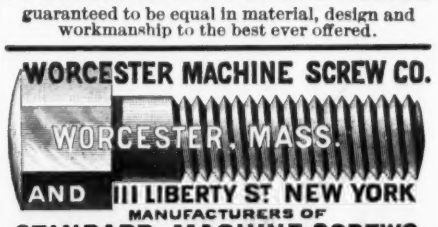

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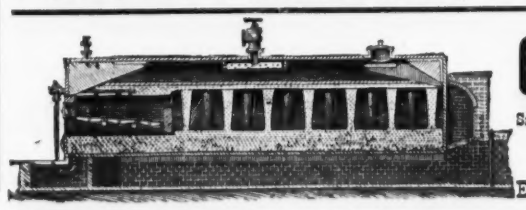

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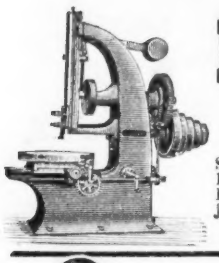

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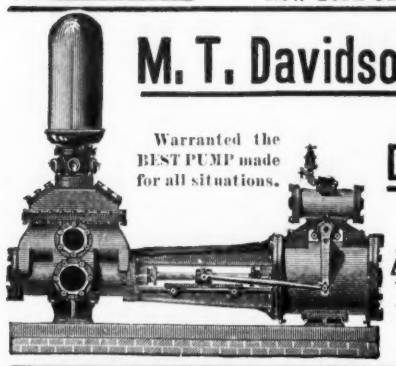

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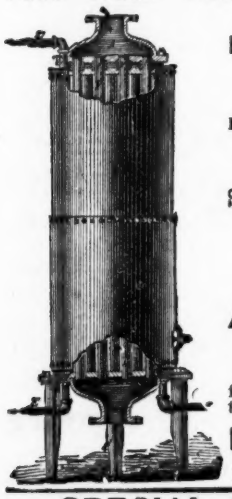

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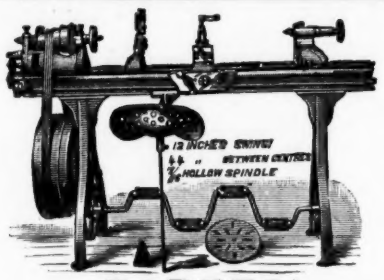

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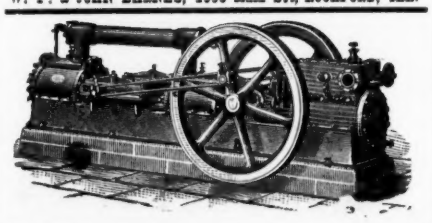

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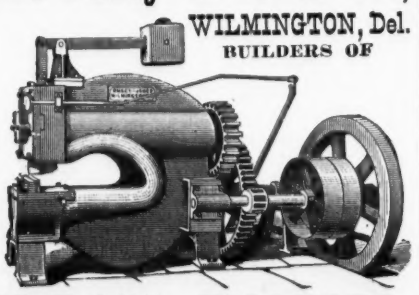

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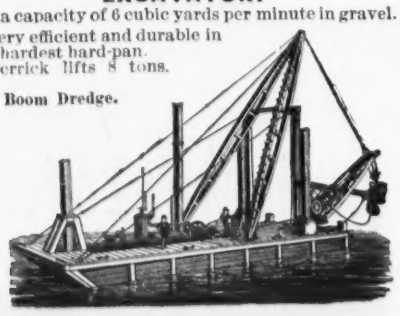

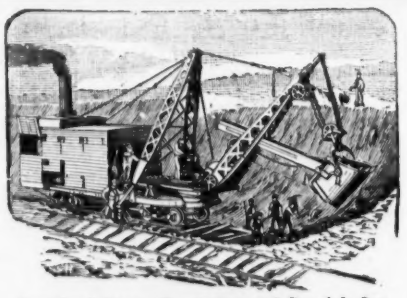

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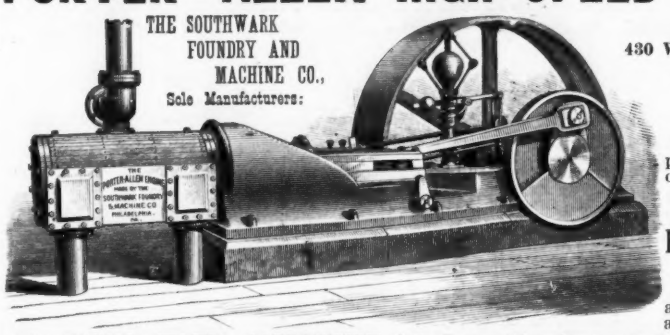

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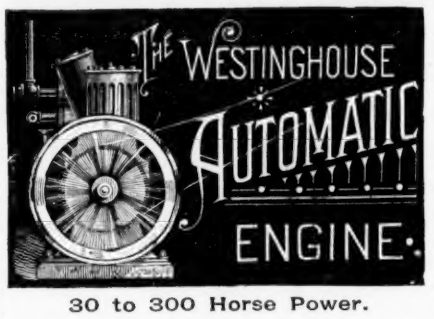

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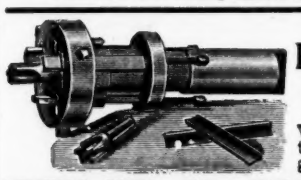

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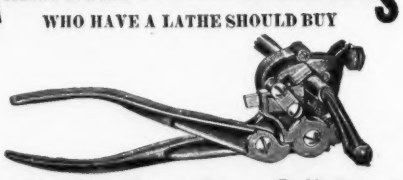

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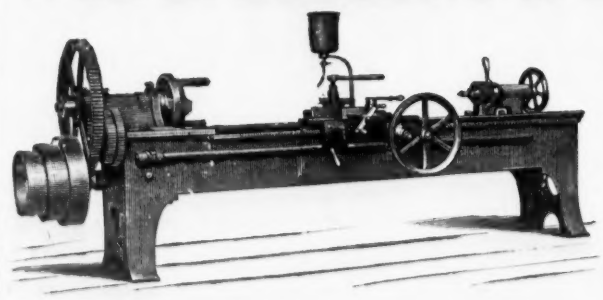

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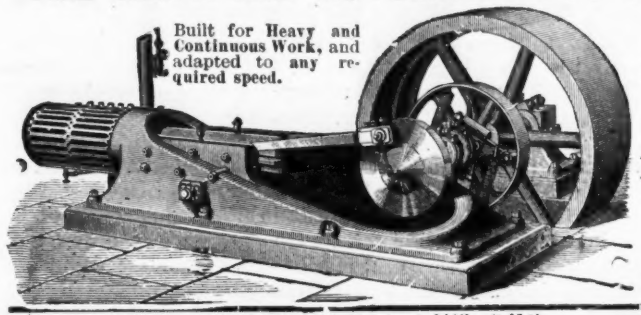

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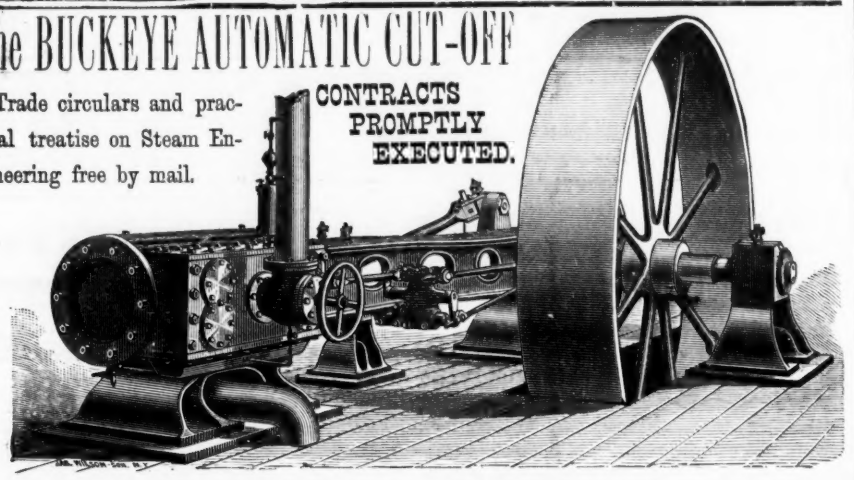

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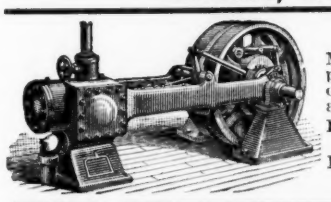

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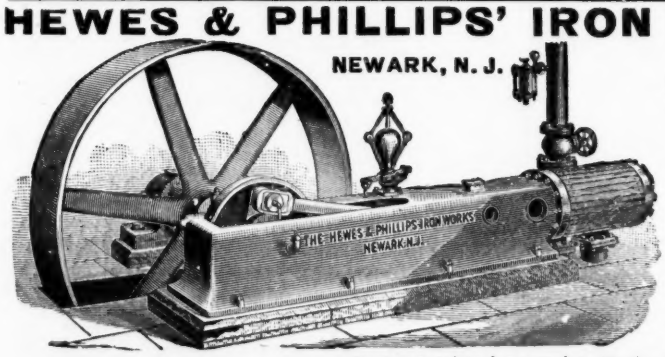

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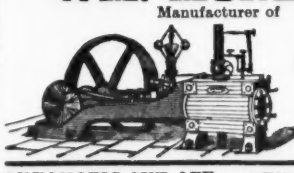

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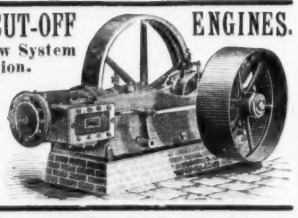

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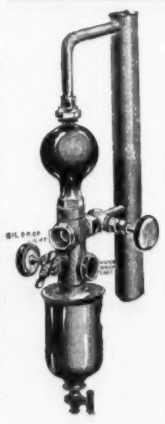

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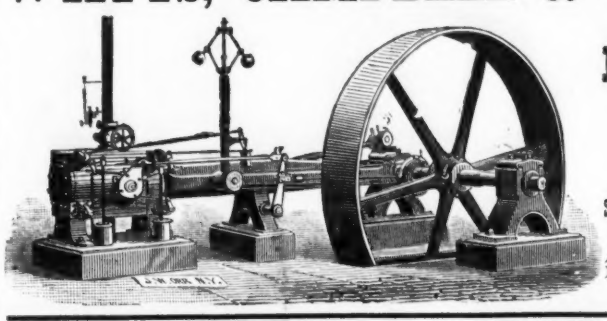

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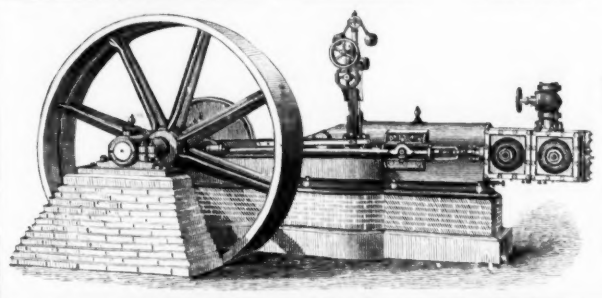

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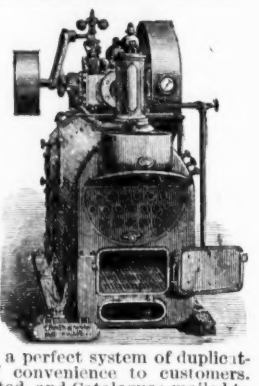

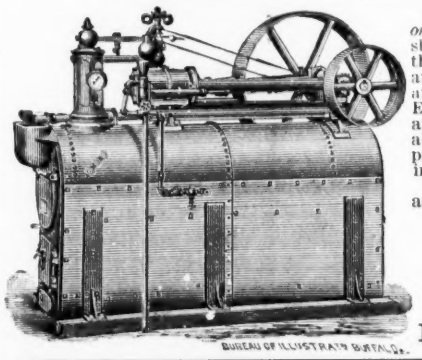

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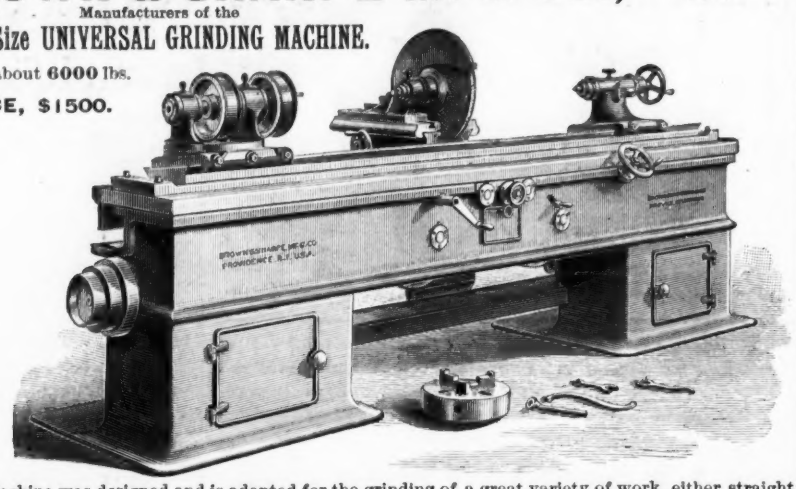

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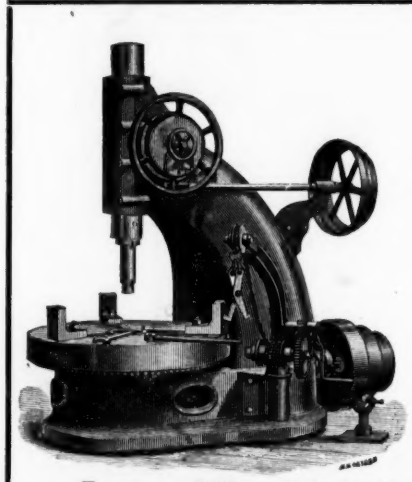

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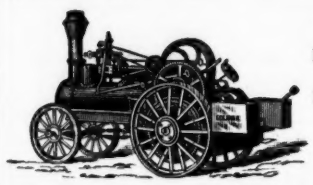

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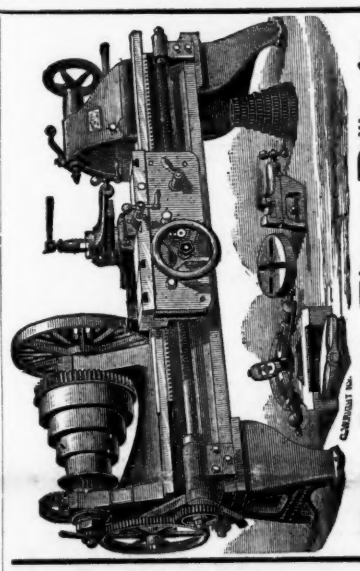

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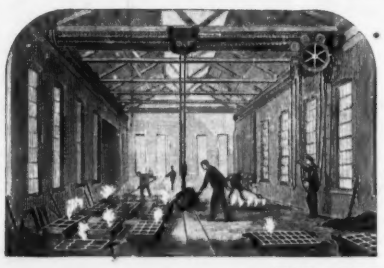

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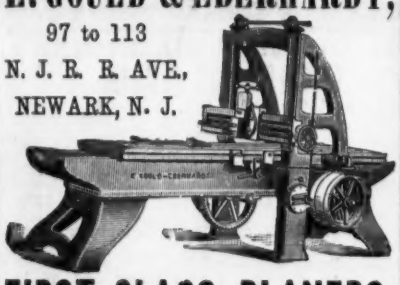

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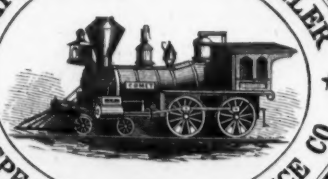

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